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Amateur Television Quarterly

ATV Working With Cops And Fire
by Gordon West - WB6NOA

New Products and Reviews

A New ATV Mode - EBE - "Earth - Balloon - Earth"

Regular Columns
by Ron L. Sparks - AG5RS and Mike Collis - WA6SVT

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ATV Application notes, links, catalogue, price list, etc.

ATV

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≥20 Watts p.e.p. Output -Adjustable, down to 2 watts pep to drive 100 watt amps like the Mirage D1010N-ATV

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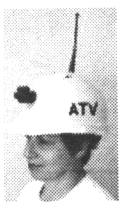
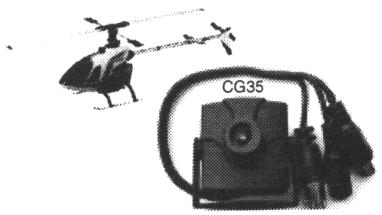
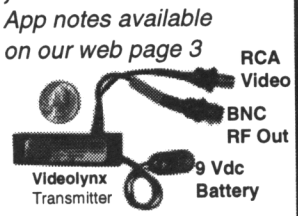
Front panel select 426.25, 427.25, 434.0 or 439.25 MHz transmit frequency, no more extra crystals to buy - other freq. by special order. Sensitive low noise GaAsfet downconverter tunes whole 420-450 MHz 70cm band down to your TV channel 3 or 4 for receiving. The rear panel has a type N antenna jack and type F jack to the TV set. Front panel phono jacks accept composite video and line audio from your camcorder or VCR. Requires 12-14 Vdc @ 5 Amps. 100% duty cycle. Just add camera, TV and antenna and you are on the air! Line of sight DX is over 100 miles with DSFO ATV-25 ($169) antennas at both ends, 21 miles with OAL 5L-70cm's ($75).

Hard Hat Cam, R/C Vehicle, Rocket, Balloon ATV





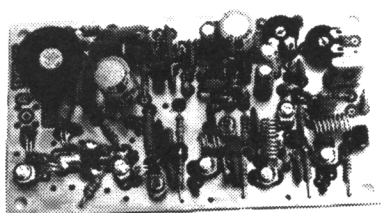
App notes available on our web page 3



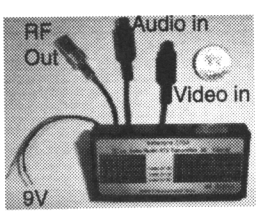
CG35 mini color camera.....$99
1.5" sq., 3oz., 330 lines, 6mm lens, Sony CCD, mic/line audio output, takes just 9Vdc @30ma.

Videolynx 434 MHz Video Xmtr.....$99
50-100 mW, .6x.8x2.3", 1.5 oz., 9V@40ma
Great for line of sight up to 1/2 mile.

TXA5-RC 1.5 W ATV Xmtr board....$129
For greater DX to 5 miles dipole to dipole. Proven ATV transmitter for Rockets, Balloons and R/C aircraft. See page 3 of our web site for application notes. Comes with one crystal you specify on 426.25, 427.25, 434.0 or 439.25 MHz. Takes 12 to 14 Vdc @ 350 ma.



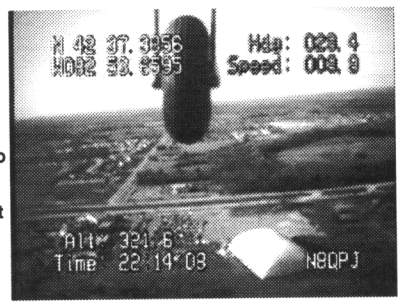
TXA5-RC 1.5 W pep 2.25x4.0", 2 oz.



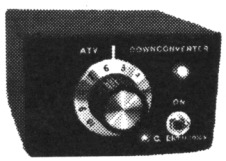
NEW!

Videolynx Z70A 4ch ATV Xmtr with sound.....$149
Now you can plug in the line audio from the CG-35 color camera and have audio with your hat cam. Digi-switch select 439.25, 434.0, 427.25 or 426.25 MHz as well as internal video and audio test generator. 50-100 mW RF out, .75x1.5x3.25", 4 oz., 9V@250ma.- two 9V alkalines.

FREE UPS surface shipping in the Cont. USA on orders over $70

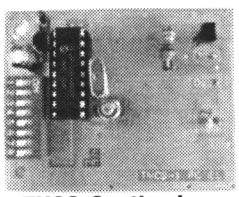


Video ID Boards
from Intuitive Circuits
See page 7 of our catalogue
Overlay your call, GPS or other info on your camera video
$99 to $139



Model TVC-4G ATV Downconverter
tunes 420-450 MHz to ch 3
Only $99
TVC-12G 1200 MHz $109

Just want to try receiving ATV, lend to a friend, go portable or for R/C but with the best sensitivity? Get this low noise downconverter! Connect between your TV set and antenna. 12Vdc/115 Vac wallplug power supply included.



TVCS Synthesizer Board 2.4x1.8"

***NEW!* Downconverter Synthesizer board TVCS-x.....$79**

Add this board piggy back above your tuneable TVC-2G, TVC-9 or TVC-12G downconverter board and get 4 or more crystal locked selectable channels in the band. Easy to install and operate.

http://www.hamtv.com 10/2002

Hams, ask for our free ATV catalogue or download from our web site - AM, FM, 70cm to 10GHz
Application notes can be downloaded or requested from page 3 of the web site - We have it all!

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Amateur Television Quarterly

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Editors Notes

The following pictures are from the State Street Mile, a race that is held every year in Rockford, IL and they love to have us for voice and ATV. This year we tried something new, mobile ATV. There is a truck that drives in front of the lead runner with the un-official timer and we put John, KA9SOG, on board with a mobile unit (P.C. Electronics - 440 MHz - 20 watts).

This year I was at the finish line and saw how important ATV was. We were having a little interference on the two meter repeater up to a half hour before the race started. The OFFICIAL timer, located at the finish line, is started with the sound of the gun over two meters. But when that does not work, they start it with the puff of smoke from ATV! It was a lot of fun.

Photo 1 shows the setup that Rich, K9PK, had at the 1/2 way point. He was receiving both 2 meters and video on 439.25 MHz. The other pictures, Rich converted from the video he captured. Photo 2 - the starting gun just went off (see the smoke) with Scott, KB9YRW, capturing the sound from the gun. The clock at the finish line is started from these signals. Photo 3 - the race is off. Photo 4 - John, KA9SOG, riding in the back of a truck capturing video of the lead runners - MOBILE ATV!

ATVQ

Gene Harlan - WB9MMM - Editor ATVQ

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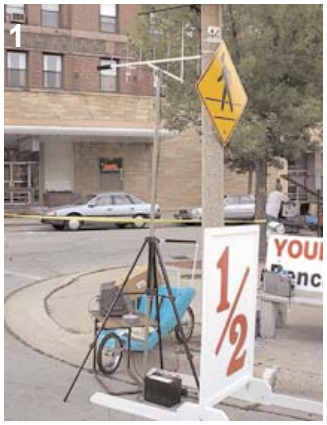

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What's on (A)TV Tonight?

Our program of sending tapes that can be shown on ATV has started and the first tapes are on the way to the first list. We have two tape submissions at this time and two more promised. I also have material to put together that will amount to possibly another two.

If you are on the list, make sure that when you get them, do not keep them forever. View them, show them on ATV, show them to your local club if you would like, make a copy if you would like to keep one and then send the original on to the next on the list. I am sending the originals out so as not to loose quality. In some cases I may only get a copy (of a copy of a copy...), but this is for fun and we need to enjoy what others share with us.

If you would like to join the group, take a video of anything that you think might be of interest to show on ATV and send to ATVQ, 5931 Alma Dr., Rockford, IL 61108. Include your address so you can receive tapes as well. I've enjoyed the two submitted so far (one of my perks is I get to see them first!). I hope to see tapes from you!

Gene Harlan - Editor
ATVQ

ATVQ

ATVQ TO PAY FOR ARTICLES!

Payment for Technical Articles

ATVQ will pay for certain articles that it publishes. I will outline the policy here, but it will be subject to change as needed to make sure that ATVQ continues to be an ongoing publication. ATVQ will pay $25.00 for technical articles that are published and are a minimum of 2 pages. While this is not a great amount, I hope it will encourage more technical type articles to be written. Exceptions will be articles that are written by a manufacturer/seller of equipment that is being written about. While I do not want to discourage this type of article, the article itself is an advertisement of the product. Articles from clubs will be encouraged, and I would expect they would like to share their information with the ATVQ readership. Information gathered from the Internet will not be paid for and is mostly small filler items.

Ideas

Do you have an idea for an article that you've said to yourself that you wanted to write, but never did. Feel free to check with us to see if it is of interest, or write and send it in. No guarantees that it will get published, but if you don't try, you will never know. I'll be looking to see what you can do!

ATVQ

CONTRIBUTORS GUIDE

Preferred method of receiving articles is from **Microsoft Word**, however **Wordperfect** is OK too. Next preference would be **ASCII text**, followed by **typewritten** or **hand written** (clearly). Diagrams or pictures (B&W or Color) can be sent in hard copy, or if you scan them in, save to PCX or JPG formats (actually I can read about anything). If you send a computer disk, make sure it is PC (not MAC) format.

When sending in articles in Microsoft Word, please SAVE with FASTSAVE OFF and save in Word 6 format. Also, articles written in any word processor, consider what will happen when it is re-formatted to fit the style that I might put it in. An example would be setting up tables or adding figures into the article. They can be very hard to strip out. If possible, put the tables, figures, each in a file by itself. This will help me to be able to import into the magazine format.

Articles can be sent to: **ATVQ, 5931 Alma Dr., Rockford, IL 61108**
or to our email address: **atvq@hampubs.com**
Also note our web page address: **http://www.hampubs.com**

ATVQ

"ATV WORKING WITH COPS AND FIRE . . . .But how close should we get?"

by Gordon West - WB6NOA
2414 College Drive
Costa Mesa, CA 92625

About twice a month I receive a phone call from an individual or group wishing to obtain the entry-level amateur radio Technician class license that is absolutely contrary to the spirit (and sometimes the rules) of the amateur radio service. I keep track of these individuals and organizations who wish to obtain the entry-level ham ticket JUST for their own little private communications system.

Hang gliders wanting their own private chase car link

A yacht owner wanting his own private talk channel to his skipper

A remote radio link into the distant telephone office

Access only for ship-to-shore e-mail AirMail service

Around-town business messaging with a licensed secretary

A city or county private ATV link at 2.4 GHz

Public safety agency looking to add additional day-to-day comm channels

I take about 15 minutes to explain what the amateur radio service is all about, and that obtaining a ham license individually or as a group does not necessarily mean they have open access to all frequencies within their license class. Many of these callers don't understand why a training school would intentionally talk a prospective tuition-bearing student out of signing up for the ham class!

Yet other phone calls may come from individuals who very well might understand what hams are looking for in new ham radio operators, but will still try to set up their own private and dedicated radio network ostensibly for just their own necessary comms.

Pilot Jeff Van Es, N6JSV, (left) looks at helicopter picture on an ICOM R3 with Gordon West (right).

Gordo using an ICOM R-3 to check out picture clarity from the F.L.I.R. cameras.

The yellow ATV bag ready for liftoff.

THEY ALL WANT ATV

Most recently I received a series of phone calls from a major local city fire department wanting me to train their personnel to the Technician class level for amateur television operation from their helicopters. They explained to me they were well aware of the rules and regulations and everything they would do within their agency would be Part 97 compliant. They were insistent that a class would be taught to obtain Technician class privileges and all of the frequencies for ATV that the Technician class license would allow. I was insistent that their proposed use of amateur television in their million dollar fire department helicopters was totally out of the spirit of what ham radio ATV was all about. They weren't much interested in my "out of spirit" dialogue, so out came the rule book and our local 2.4 GHz band plan to better illustrate what ham radio ATV IS and what routine fire department video proposed for ham radio frequencies was NOT. I could confirm this by further exploring their keen interest on ATV as 2.4 GHz.

The camera and transmitter and its associated mountain-top remote receiver is part of the WESCAM system for aeronautical and point-to-point use (www.westcam.com/splash.htm). This particular agency was sharing one 2.4 GHz channel with the commercial television traffic reporting service and was looking to use the equipment on the "easy license" Technician class ham channels. When I explored further the technical aspects of their equipment onboard, the first 4 channels ended up at 2407 MHz, 2419 MHz, 2431 MHz, and 2443 MHz. While each of these frequencies is within the ham band, none end up squarely on any ATV band plan. When I questioned where these 4 frequencies came from, it was explained to me they were simply chosen with 6 MHz plus 6 MHz separation, so they could easily switch from one channel to another without overlap. They worked this out on paper, and it seemed logical to them without any second thought about their local band plan that Tom O'Hara, W6ORG, the local Southern California ATV Coordinator, closely monitors. Tom points out that 2419 MHz will fire up the ATV repeater links on 2417, 2443 will open the 2442 ATV repeater input and a couple of other areas, and 2407 will of course interfere with those hams trying to receive AO-40. 2431 might be usable, but the transmission bandwidth is such that it may interfere with the 2442 repeater inputs.

It gets better yet—it was explained to me by one of the fire department personnel who also dabbled in electronics that there would probably be no problem with any band plan or interference because the signal would shoot from the fire department helicopter directly to a distant mountain-top receiving site, and all antennas would be active and tracking parabolic radiators. How they get the signal from the mountain peak back to their control room or EOC would probably be wire line, hopefully not another retransmission on another 2.4 GHz channel!

If ever there was an example of "not in the spirit of ham radio," sending a picture just for their own eyes to see to a mountain-top remote clearly points out they had no interest in playing ham radio at all, other than to misuse our frequencies.

Our ARRL Southwestern Division Director, Mr. Art Goddard, W6XD, asked how the following sections of Part 97 would be addressed by this operation:

The ICOM R3 tunes in ATV from the helicopter up to 10 miles away simplex.

The ICOM 2800 ham radio can display ATV video from the helicopter VCR video output jack.

The general prohibition on one-way transmission (e.g., helicopter to ground), 97.113b

The requirement not to cause interference to other stations (no TV receiver in helicopter to listen before transmitting on a channel that may already be in use), 97.101d

The prohibition on transmission on behalf of an employer, 97.113a3

The requirement for station identification, using CW, phone, RTTY, or NTSC image if the transmission consists of NTSC video in whole or in part, 97.119b

"I hope we won't encourage the fire department people until these questions receive satisfactory answers," states Goddard, W6XD. When I pointed out these questions to this major city fire department, they saw once again their battle for ham frequencies by both an FCC petition as well as through the back door by trying to license their personnel would be an uphill battle.

I believe the case is closed

Or so I thought. . . .Mr. Goddard then focused attention on a local city project where I and several active ATVers had worked up an emergency preparedness program linking our city helicopter program into the disaster plan at our ham radio station at the city Emergency Operation Center. Our city ham radio group has always been active, but there wasn't much we could offer our local city that they didn't already have—the city had already gone 800 MHz digital encrypted; already had mobile data terminals and plenty of emergency back-up, talk-around simplex frequencies; plenty of high-band redundant systems; and really not much need for our 30-member RACES-affiliated ham radio communications team.

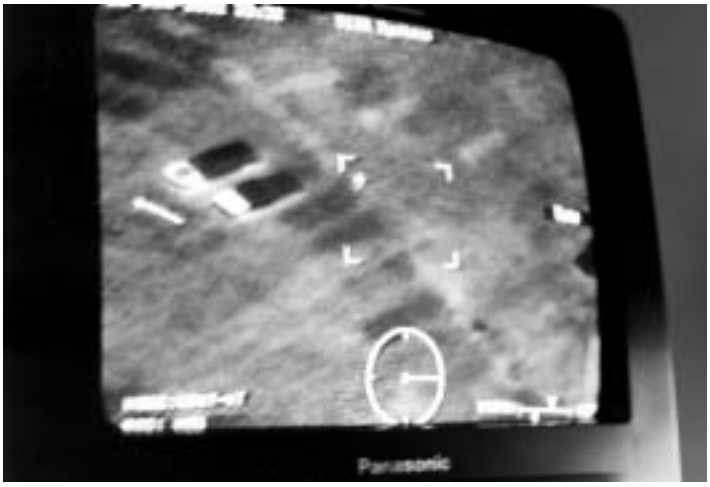
When our team become involved with amateur television, our ham radio group soon gained some big status in the overall emergency preparedness program. Since our city already flies with licensed ham radio pilots, could the pilots train with our ham group with ATV and, in case of an emergency, or one hour a month for RACES-permitted drills, could they send pictures back to the ham station at the Emergency Operation Center?

That was 5 years ago, and I am happy to report spectacular cooperation between our city and the local hams, especially when we bring out our ATV gear. Flying with ATV was icing on the cake!

Putting ATV in our jet helicopters required portable installations so as not to violate FAA rules. Tom O'Hara, W6ORG, has authored several papers for RACES organizations on how to fly ATV in planes and helicopters. He is also quick to point out the rules regarding attaching anything to the air-frame at 12 volts DC. We went with his suggestions and our ATV portable package works swell. We even tied it into the forward-looking infrared system on the aircraft, so what the pilots would bring up on their screen, we see on the ground.

The ham pilots NEVER transmit without a ham at a downlink station requesting camera up. They do not transmit on a regular basis; they don't transmit routine police business, no car chases, no surveillance. They only transmit when the hams ask the to squawk pictures, and this has mostly been for short drills. We transmit only on ATV simplex, 426.250 MHz, and the popularity of our program has even attracted the attention of the local amateur television network repeater group—and they like to see our helicopter sending pictures coming through their linked repeaters, input 434 MHz.

We learned that the helicopter at 600 feet creates big shadows for reception to the repeater up 5,000 feet! Simplex reception from the ground is always better, yet the repeater may take the signal and retransmit it to many systems throughout the state.



Ham television from a police helicopter in the forward looking infrared mode.

1250 MHz ATV downlink 20 miles away as seen from the helicopter.

Everyone is fascinated with what they see during our brief tests and demonstrations.

Again, NEVER is this system used for police business or routine surveillance or car chases. The downlink does not output to the watch commander, and the only way for someone to see the downlink is for a ham to open up our ham station at the EOC, or operate the down-converter in the mobile command vehicle.

But our local ARRL director indicates an officer on duty transmitting ATV, even as a licensed ham, might be violating the "prohibition on transmissions on behalf of an employer."

Yet when you look at Chapter 2 of the FCC Rule Book, published by the American Radio Relay League, there are several pages on what is allowed when transmitting on ham radio when you might be presently working your regular business. Are the licensed ham pilots sending ATV on behalf of the city? Not really— this is emergency preparedness and every city across the country may be working ham operators into their overall EOC program. Are the ham pilots getting compensated for sending these ATV signals? No again—they are paid as pilots, and their personal ham license and practicing ATV for emergencies is not part of their regular job.

". . . .Amateurs are not usually permitted to provide communications on behalf of their employers or to be paid for such communications. . . .in limited circumstances, the fact that amateurs are still on the payroll is incidental." And this same Rule Book points out recent studies of how the National Weather Service hams (many times paid personnel) may operate on local nets and receive weather reports from ships at sea on 20 meters. Or what about the weekly 40-meter nets where hams at local EOC's, on the payroll for that local agency, regularly run check-ins for emergency preparedness.

So the big question is, if someone is employed and is transmitting ATV, does this mean what he is doing is possibly business communications for his employer for pecuniary aim or money? I doubt it.

The other questions that were raised deal with listening before transmitting to insure an open channel, and each pilot has his own favorite ICOM R3 to doublecheck that the simplex frequency is clear. Is it a one-way transmission? Not so— they don't start transmitting until the ham down on the ground gives them the go-ahead, also checking for an open channel and also checking on the 2-meter liaison voice frequency for simplex ATV.

The identification is accomplished on both the forward-looking infrared computerized system, and as back-up, our local officers have even put the call sign on the skid of the aircraft that they can pan with the camera.

But probably the biggest thing that we must come to grips with when offering amateur television to public safety personnel in disaster preparedness is the overall intent of the program— the ATV is not to give them daily shots of the city from the air for traffic reporting, surveillance, or pursuits, but rather ATV is there when the tornado hits or the building collapses or a fire envelopes the top floor. And to train for these emergencies, now-and-then tests sending ATV to the hams on the ground are required, recommended, and enjoyed by the overall ham community tuning in with their down-converters and little ICOM R3's.

And finally, with those who question our ATV activities in cooperation with an emergency preparedness group who may be city employees and have any question about our first amateur radio rule, 97.1(a), ". . . .Voluntary non-commercial communications service, PARTICULARLY WITH RESPECT TO PROVIDING EMERGENCY COMMUNICATIONS. . . .", if we're going to provide emergency communications, we obviously must send our transmissions to a dedicated emergency group who is equipped, prepared, and trained to receive our transmissions. These groups are sometimes voluntary, but usually city municipalities, county communication units, fire services, and the like. Is amateur television from licensed hams who are eager ATVers in a city helicopter under scrutiny because it is something relatively new where we need to shut things down and analyze the rules to pieces? It is hard to believe that an

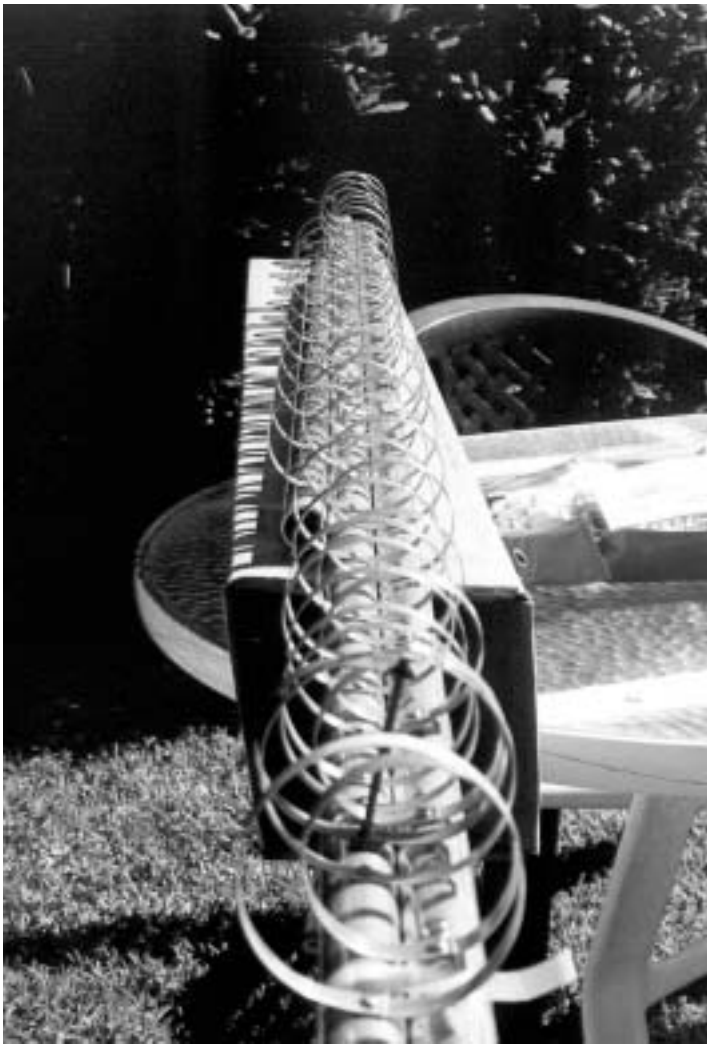
elected official representing the American Radio Relay League would not look at the overall scope of hams communicating with the city and see all of the positive benefit that ATV has to offer in emergency preparedness. Unlike our other larger city that wanted to use ATV for just their OWN use, what we have here in our smaller city are licensed pilots who have been hams for many years who got interested in ground ATV, and then wanted to try it from their own helicopter to see the value of ATV in the sky. These same pilots are avid hams when they are off duty, so just being ON DUTY makes them illegal to continue to enjoy their hobby and practice for emergency preparation?

Municipalities throughout the country might better understand the capabilities of local ham groups if we can come to them and give them some of this gee-whiz technology that they didn't know was available from volunteers. APRS, ATV mini-cams and transmitters mounted on rescue dogs, packet radio for a long list of supplies during the emergency, slow-scan television for a shot of the evacuation area, long-range HF communications to get word out of a disaster area that they survived the tornado and help is needed when all cell phones are down—these are just a few of the many things that ham radio operators may offer the city who might not even know these free services are available.

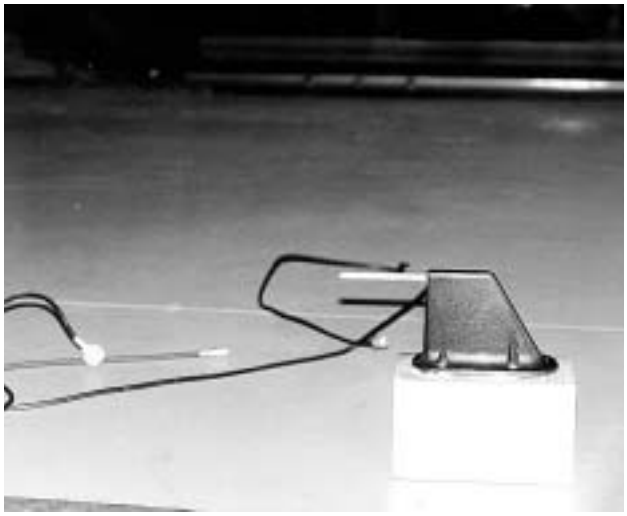
I shake my head when I see a group of avid ATVers get accepted by a small city to work into their disaster communications plan, only to be criticized by someone from the outside who wants to nit-pick whether or not the pilots are indeed on the clock when they flip the switch and send us P5 pictures to get us all tuned in and ready for this same pilot to send us pictures after the big one hits town—whatever type of big one occurs.

Let's not lose track of our primary emergency preparedness mission in ham radio, nor lose the overall wide-angle view of a group of hams in emergency preparedness using amateur television legally. Here in Southern California, our small city ATV program is prime time for disaster preparedness with everything positive for all that the amateur radio service and ATV has to offer.

ATVQ

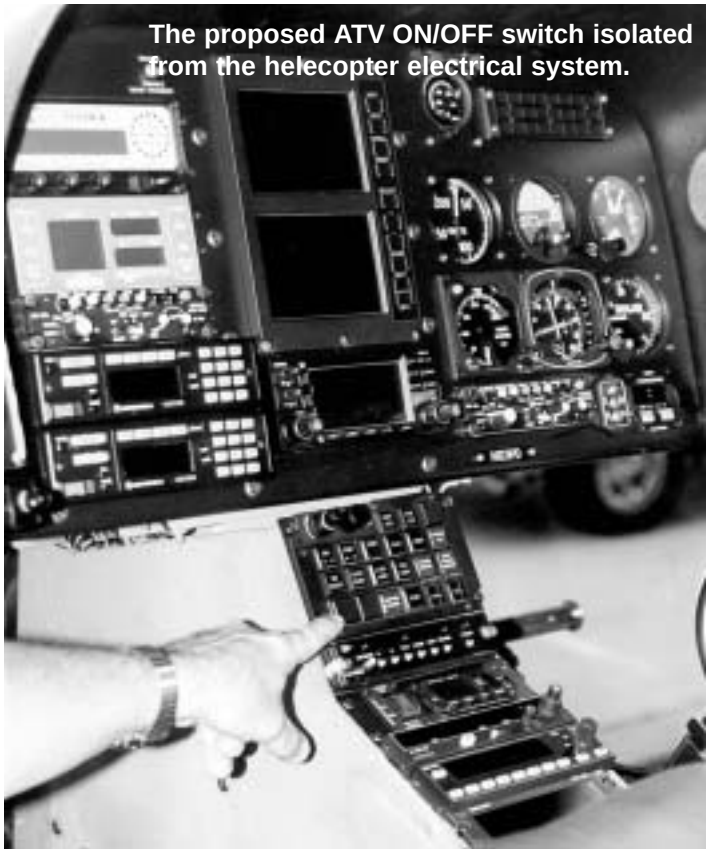


The loop yagi from directive systems is perfect for ATV 1250 MHz repeater reception.

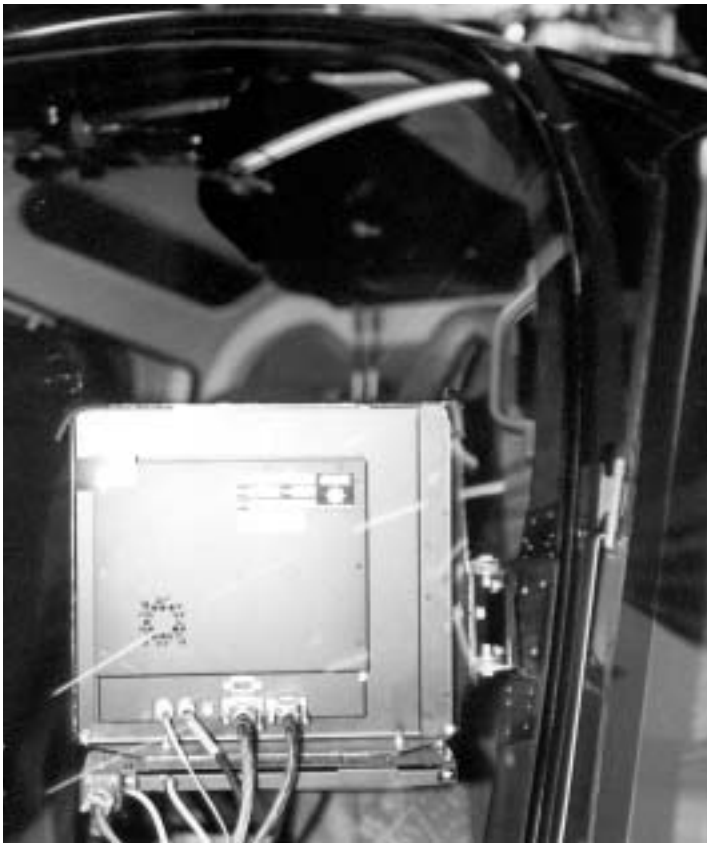


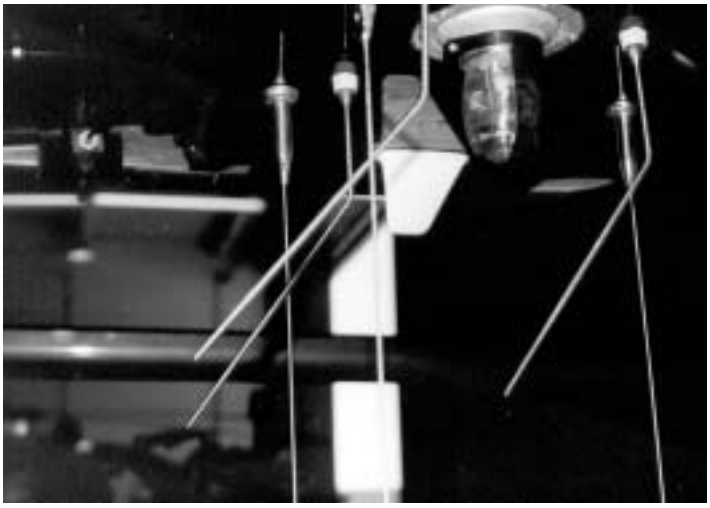
Above and left - Fabricating the 434 MHz helicopter antenna mount for the ATV transmitter.

Photo Credit: Gordon West



The proposed ATV ON/OFF switch isolated from the helecopter electrical system.

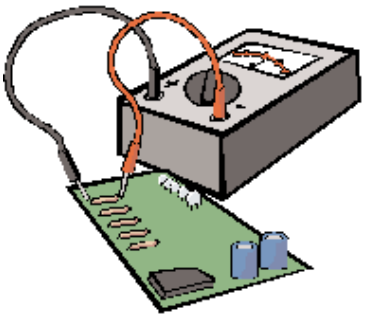




Top right - Chris)airship chief mechanic), KG6EGL (L) and Bardy, K6FAB, discuss where to mount the ATV transmitter in the helicopter.

Bottom left - We stay away from the Lojack (tm) antenna system (at 220 MHz) to prevent desense from ATV TX.

Bottom right - The back of the color LCD aircraft monitor to display the airship's camera output.



Sparks from the Bench

by Ron L. Sparks - AG5RS - Email: atvq@sparkles.com
P.O. Box 945
Katy, TX 77492

Regular Featured Column!

"Esteemed Elmer, sir, how do I get started in Amateur TV?"

"Any journey must begin at the start, young Op."

Any journey, that is, except those I take. Somehow I seem to manage to jump into the middle of new experiences with a cheerful eye on the most complex end of the technology. Only after a little bit of hard-learned knowledge takes hold do I seem to grasp the need for beginnings.

I guess that is the way ATV is for me. In the last several years of working with various complex ATV aspects, I never took the time to do some of the beginning things. Sure there have been lots of hat-cams, car-cams, and hidden-cams but I have not done one yet. That is a serious oversight because they are so fun. Well, by golly, it is time for me to correct that situation

Where does it start?

This project started during a dinner with my brother. He was building small model rockets with his children, just like we had done when we were younger. He asked me if I could build an ATV transmitter that he could mount on his rockets. Naturally I answered, "Yes". Remember what I said about jumping in the middle of complexity? It turned out that, after much design and effort, I could not get it to work. That was several years ago and a lot has changed, but the lessons are still valuable.

The problem with the rocket-cam project was one of weight. He was building very small rockets and the total payload was limited to less than 6 ounces (175 grams). The project killer turned out to be the battery weight for the power requirements. Time marched on and all the parts went into various obscure parts of the shack, where they remained until a few weeks ago when my wife asked about remote cameras.

Her mother is quite elderly and has an apartment in an assisted living facility. During a recent visit they discussed a number of small items that neither could find. So my wife asked if we could install a small camera to help determine whether things were just being misplaced or if something more sinister was occurring.

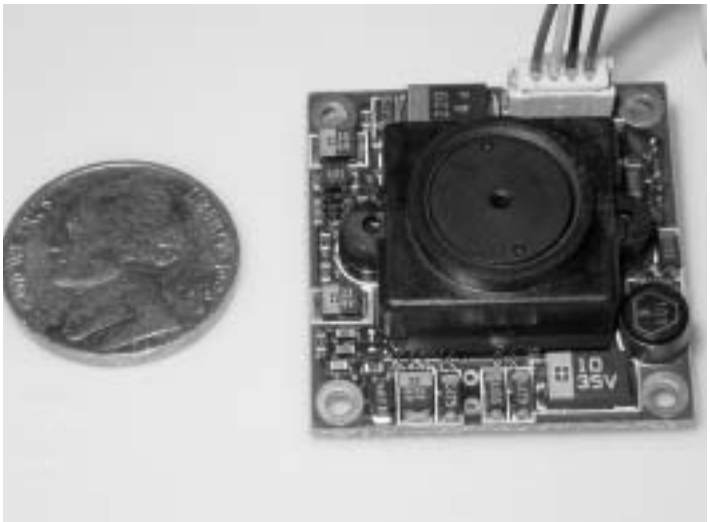
That gave me the motivation to dig out all the old rocket-cam parts and see what could be done. But, this time I had learned my lesson and decided some planning and design were needed first.

Reviewing and Preparing

In any project it is important to decide on your objective and then determine what is available to meet that objective. My first objective is to build a very small ATV system that can be used for many different tasks. The second objective is to have fun by using ATV to see things that I normally cannot.

A basic system that can accomplish these objectives would include:
* A miniature camera
* A small ATV transmitter
* A compact power source for the transmitter and camera
* A small, omnidirectional transmit antenna
* An easy to use receive converter
* A receive antenna which can work over a path of few hundred feet
* A video converter and display

The first four items will be the remote transmit portion and should be as tiny as money will allow, as long as the range and reliability are still reasonable. One of the problems with the ultra-tiny transmitters you see advertised is their limited power output. In some cases the few milliwatts they put out will be adequate. But, as you shrink the transmitter power and antenna size both reliable reception and useable range will decrease dramatically. The two limiting factors for remote transmitter systems are almost always cost and power requirements.



Phtot 1 - Openboard camera

The cameras that I have for the project are simple black and white pinhole units. Their resolution is not great, but they have a unique advantage for this project as we will see later. One has a metal case around the board. Since the project will need a nice case for the power supply, batteries, transmitter, and antenna the encased camera would not be required. Photo 1 shows the open board camera and its relative size.

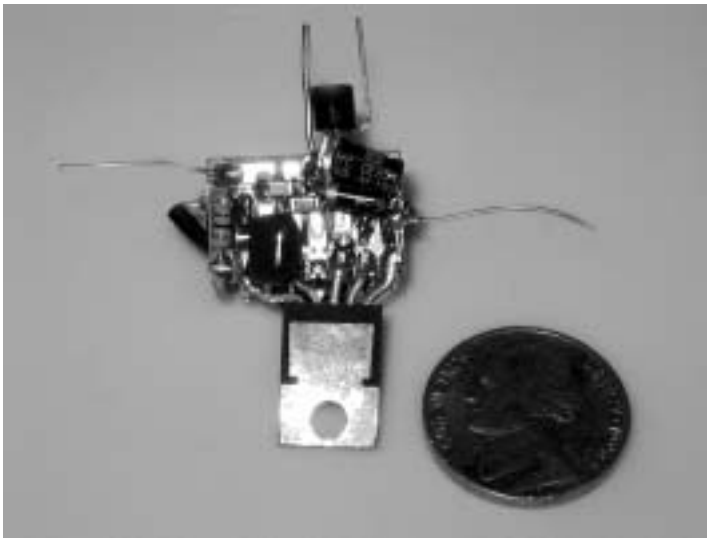


Photo 2 - Miniature switching power supply

Back when I started the rocket-cam project I discovered that there are a lot of unwanted things that happen when the voltage supplied to the camera and the transmitter change. For example, batteries can easily swing from 14 volts down to 10 volts (or less) and still be within their design specifications. That amount of change can create real problems for some cameras and transmitters. My solution was to design and build the miniature switching power supply shown in Photo 2. It will take any input from 6 to 15 volts and output two regulated supplies - 13.8 volts and 9 volts up to 7 watts total. The details of this supply were published in my article in the July 1997 issue of 73 Amateur Radio Today.

Photo 3 shows the camera, power supply, and a 70 cm 1.5 watt transmitter. This was the original configuration for the rocket-cam. The transmitter is from PC Electronics and is specifically designed for ATV portable use. It has a large power output for such a small package. This particular transmitter is AM so it will be a bit susceptible to noise interference, but it will have better weak signal characteristics than an FM unit. In a complete implementation it would be hooked to a 70 cm ground plane antenna which will be covered in the next installment of this column. I will discuss my newer 2.4 GHz FM unit then, too.

The last three items on the list are for the reception of your remote transmitter and are generally pretty straightforward. If you want the easiest setup to use with a moving transmitter, the antenna needs to be omnidirectional. If the transmitter will be stationary and you want maximum range, a yagi type antenna will be your best bet. The receive converter needs to match the remote transmitter in frequency and mode. It will generally have one of two types of output. Either modulated RF on TV channel 3 or 4 or baseband video (NTSC in the USA). The output connector will nearly always be an "F" connector (like standard cable TV connections) if it is an RF output. Baseband video connectors are often a phono jack. The emerging convention for these is for video to have a yellow insulator and a red and/or white insulator for audio.

The last part of the receive system is a device to convert the video into something you can see. Lots of times a TV is all that is required. Many TVs have video connectors and can take the converter output directly regardless of which type signal it outputs. Some older TVs do not have a video connector and a simple solution is to use a VCR between the converter and TV.

So we now have a nice system concept and can see how well it would fit our objectives.

Refining the Approach

Let's think about the objectives again though and see how the described system would work. Suppose that we want to use our system on an RC car and watch things from the car's viewpoint.

Sparks Continued on page 50

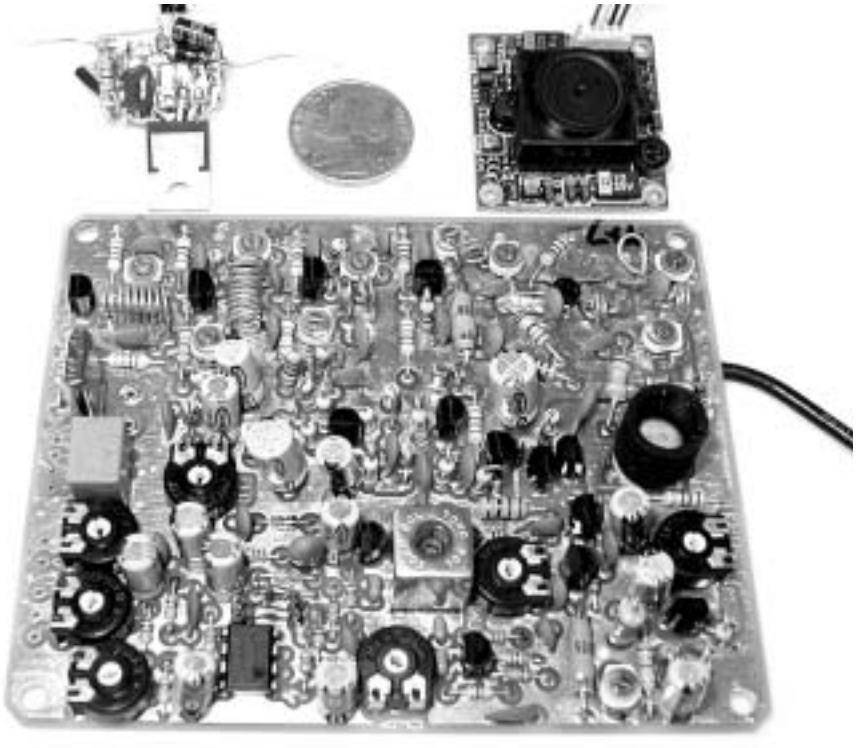


Photo 3 - Camera, power supply and 70 cm 1.5 watt transmitter

THE VIDEOSCANNER FROM G1MFG... A handy ATV item

A Technical Review
by Art Towslee - WA8RMC - Email: towslee@ee.net
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The Videoscanner from G1MFG is a small semi scanning 5" B/W portable TV that operates from 2300 to 2500 MHz from an external 12vdc source. It has a built in "paddle" antenna similar to the one used in the Wavecom receivers to complete the compact self-contained all-in-one receiver.

This receiver can be handy to take with you on field trips, repeater site search/repair missions, interference hunting expeditions or, for the sports enthusiast, to the game to tune in blimp TV links or to the auto races to tune in the race driver video. Perhaps the black/white screen is all that is needed to "observe" one of the many hidden surveillance video signals in use today by a variety of sources. The included power cord has a plug that fits an automotive cigarette lighter socket. If a separate battery is desired, the current consumption of about 1 amp allows about 10 hours of use with a 10 Amp hour 12 volt battery.

Although this receiver may not be ideally suited as a primary ATV receiver, it comes in handy as a portable compact receiver for signal verification purposes. Under those conditions, a color display is not usually needed. However, if a color display IS needed, simply use the rear video output jack to connect it to an external color monitor.

The scanning feature is not a true automatic scanner that scans the band and stops on a received signal but it continuously scans the band from 2.3 to 2.5 Ghz and then repeats which takes about 15 seconds to complete. When a valid signal is observed, the side slide switch must be manually moved from position 1 to position 2 freezing the frequency. When the switch is again moved to position 1,

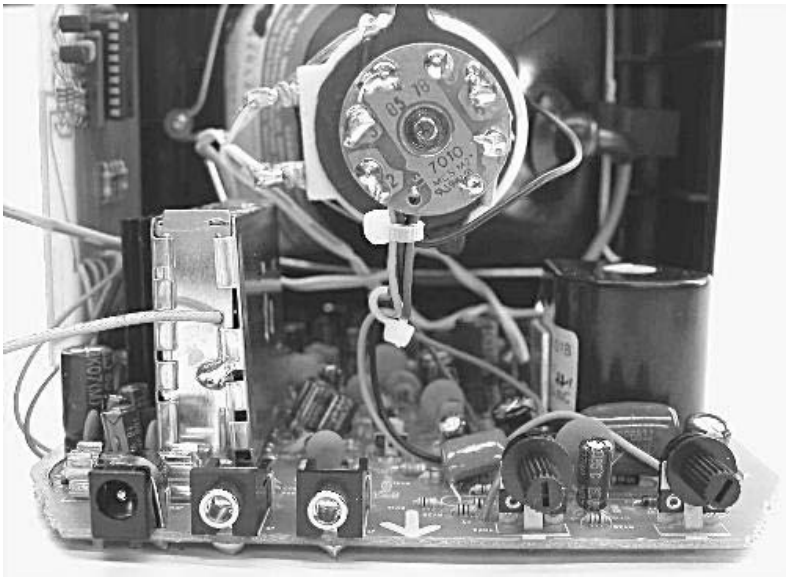
scanning resumes in the opposite direction. That way it is easy to "zero in" on a given signal. An additional aid is a slow scan feature that scans at a 1 MHz rate for approximately the first 5 seconds then accelerates to about 12 MHz/second until halted.

The video output connector, located next to the audio connector and power jack in the picture below, contains a high quality color signal that is much better than the black/white self-contained picture. The black/white signal tends to be

of lower resolution and contains some traces of trailing image ghosting resulting from poor frequency response in the CRT circuitry but after all, this display should be used to identify the signal and not judge its quality. Use the video output and external monitor for that task.

I checked the overall sensitivity and found it to be about 4-6 dB worse than the average Wavecom and about 14 dB worse than the G1MFG 13cm receive module. This may seem like a lot but remember that this is a portable unit and its main task is to identify relatively strong signals within the 13 cm ham band and not for "DX" activity. The primary weak signal receive module should still be the G1MFG units described on his web site at www.tvham.com.

The unit is provided with a built in circularly polarized "paddle antenna" permanently wired to the internal receive module. Fortunately there is enough extra internal cable to allow it to be cut off and connected to a rear mounted antenna jack. I recommend cutting the cable near the center to allow connection to a rear connector and also wiring the internal antenna to an additional rear mounted antenna jack. That way a jumper form one jack to the other will enable the internal antenna and using the jack connected to the receive module allows the use of an external antenna. I recommend using SMA connectors because they are both small and well matched to the 2.4 GHz signal.



The picture to the left shows a rear view of the circuit boards with the cover removed. The power jack is on the lower left. Next to it are the audio and video jacks followed by the brightness and contrast controls.

The 2.4 Ghz receiver module is located directly above the audio jack. Notice the small coax cable going to it which is long enough to cut in the middle and fasten to an RF input (SMA) connector to the rear case. The other half of the cable going to the internal paddle antenna can then also be routed to a rear case mounted jack for maximum flexibility.

Notice that there is a separate PCB mounted vertically at the upper left which contains the scanning and frequency control logic.

In summary, if the planned use for this receiver is for primary 2.4 Ghz reception in the ham shack, I think you'll be disappointed. If, however, its use is for portable diagnostic purposes or for surveillance service, satisfaction can be achieved. Also, because at power-up, it locks on to 2.3 Ghz making it inconvenient to set it to the desired ham band frequency each time. But, after all, the original design is intended to be used as a surveillance monitor where a number of signals within the 2.3 to 2.5 Ghz band are present from various surveillance cameras in the area. For that application the Videoscanner captures the first signal and displays it for about 5-6 seconds until the next signal is within capture range. At that time the picture would "pop" to the next higher frequency signal and so on.

ATVQ

West MI Hams Can Now Be Seen As Well As Heard

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What has been the problem with ATV in the West MI area until about 5 years ago was that to achieve the required signal to noise ratio on video for a snow free "P5" picture at the other end, and stay horizontally polarized to avoid FM interference, high gain directional antennas were typically required. However under simplex communication only two people can usually exchange video at a time especially if widely dispersed over a local area. Further trying to regularly work any distance, say from Grand Rapids to Chicago, requires at least 50-100 watts peak power, a high tower and an expensive UHF antenna array. As a way around this problem the K8DMR ATV repeater was put on the air in 1997 from the Grand Rapids Red Cross using the Grand Rapids Amateur Radio Association's (GRARA) radio room and 100' tower. Now everyone can simply point their antennas towards the same location to see the video. With sensitive receivers at the repeater and a powerful transmit amplifier the individual repeater user's home equipment can be quite modest. The repeater was initially described in the Winter '98 ATVQ article. This is an update on its current status

As reported previously the K8DMR ATV repeater is primarily a 70 cm in-band machine employing omni-directional, horizontally polarized, 6 dBd gain "rib cage" antennas for receive and transmit on 439.25 MHZ and 421.25 MHZ respectively (cable channels 60 and 57). Also as before horizontal sync (15.7 kHz) keys the repeater and our Elktronics video ID'er still goes on beating 24 hours a day like the Energizer bunny. However a 23 cm input has now been added. Further with the replacement of the original exciters (PC Electronics and Pauldon) by an ultra linear commercial exciter and changes in the amplifier chain to more powerful and more linear units than the Pauldon amplifiers we were using back in 1998 has gotten us around the intermod problems using subcarrier audio that we were experiencing then. (The subcarrier beat with the video carrier and produced a comb of outputs which, while orders of magnitude down from the video, tended to desense our receivers if the subcarrier was turned up to a useful level.)

In the last year two meter 144.34 audio has been added repeated on the sound subcarrier at 425.75 MHz along with a CW ID using an Intuitive Circuits ATV microprocessor based controller. Further on 70 cm two receivers have been employed for some time, both with 7 pole VSB filters and GaAs-FET preamps as well as a common GaAs preamp ahead of these filters. One receiver, a standard PC Electronics unit, is set for the upper vestigial sideband (roughly 438-444 MHz). The other receiver (our original receiver, home brewed years ago from a cut apart VCR with a Spectrum International downconverter added) has had its 45 MHz IF retuned for the lower vestigial sideband (435-441 MHz) of an input signal. Most users transmit full double sideband AM so both vestigial sidebands are available although the upper VSB signal is usually peaked in many ATV transmitters and therefore preferred.

In addition to the multi-cavity VSB filters for each receiver a set of 4 notch filters on the lower VSB receiver serves to eliminate any trace of the K8SN repeater located 2 miles away and operating at 442.175 MHz (deadly for upper VSB reception) or GRARA's own W8DC 444.4 FM repeater (co-located at the Red Cross site) from desensing this receiver. A separate FM receiver monitors 442.175 at all times and because there is no way to notch out this frequency and still receive upper VSB a special control circuit disables the upper VSB receiver and a PC electronics VOR used as a voter switches receive operation to the lower VSB receiver when 442.175 is active. In addition to the 4 notch filters for the Lower VSB receiver a single large cavity at the main receive input notches out the W8DC signal from both receivers even though the transmit antenna is only a few feet away from the ATV receive antenna on the Red Cross tower.

Besides the switched receivers and extensive FM repeater "interference-proofing" another recent addition has been the installation of a sensitive receiver and high-gain Comet vertical on the tower for those with transmit capability on the 23 cm band. Operation on this band is via FM video (constant power) rather than AM video used on the 70 cm. Input is at 1290 MHz using a Bensat receiver (tuneable receivers work fine in air conditioned/heated radio rooms). Also we chose vertical polarization for 23 cm due to the absence of 23 cm FM repeaters in West Michigan and our plan to add additional remote receivers using 23 cm for linking back to the Red Cross from various directions. The Intuitive Circuits repeater controller has multiple video inputs so either a 70 cm or a 23 cm signal will now key the transmitter (on a first come first served basis).

A major improvement in video quality was achieved earlier this year when we replaced our PC Electronics repeater exciter (which in turn had replaced the original “creepy peepie” exciter used back in 1998) with a commercial cable TV exciter tuned to channel 57. This unit provides excellent color and sound but low level upper VSB video (50 mw peak “sync tip” power). This is boosted by a first linear amplifier (a PC electronics 20 watt module suitably packaged) to about 15 watts peak and then input to an ultra-linear final linear amplifier (a Teltec) where the output is just under 150 watts on sync tips. After 8 poles of additional VSB filtering the transmit signal is fed to a 22 element “rib cage” antenna mounted on the Red Cross tower just below the club’s tri-band Comet “top-stick” antenna. With 6 dB antenna gain the effective radiated power is 600 watts peak. Receive is via a second rib cage antenna mounted at the same location. The receive antenna points upwards and the transmit antenna downwards. These are the same two antennas in use back in 1998 and, while home brew, are obviously quite rugged and suitable for repeater operation. All our ATV antennas are hard line fed with the transmit hard line just added this August.

Typically there is an informal West MI ATV round-table every Thursday evening around 9 P.M., using 144.34 for check in. However there is activity most every evening as people show off their stations, provide close-ups of current projects or schematics, run home movie video tapes of travels or the grandkids, provide close ups of the pets, or just enjoy a good eye ball QSO with friends. Because of the range of the repeater, stations from as far away as Central IL, Milwaukee and Jackson check in frequently, given just a slight band enhancement. Best real DX two-ways on the repeater so far have been Dayton Ohio, Davenport Iowa and Rochester MN with 1-way sightings reported as far away as near St. Louis MO.

Currently we have about a dozen amateurs within a 30 mile radius of the Red Cross with ATV transmit equipment. All have contributed time, equipment, and money to bring the K8DMR repeater on line at no cost to GRARA. (There is no ATV club as such in West MI since almost everyone operating this mode is already a member of GRARA). Our ATV special interest group is now at the critical mass where portable/mobile ATV can play a role in many other club public service activities such as the local River Bank Run which attracts world-class runners each May, March of Dimes walk-a-thons, Red Cross emergency drills and, of course, Sky Warn weather reporting. Look for a 24/7 streaming video connection on the WEB soon so one can watch the repeater from any distance (we are discussing setting up something like an ATV version of ILINK and would love to discuss this possibility with other repeater groups).

(1) Two 70 cm rib cages back to back on top left with Comet 23 cm vertical hanging down on right. Spare rib cage at midlevel on left side also mounted hanging down and currently used for UHF control. Dual band vertical used for 144.34 ATV receive and by the club station’s 440 FM rig located at midlevel above spare rib cage. Other antennas used for FM repeaters and Red Cross communications. Tower is 100’ high base at 750’ msl elevation. (Nearby Lake Michigan is 570’ msl and the 70 cm antennas favor that direction slightly, being on the west side of the tower.)

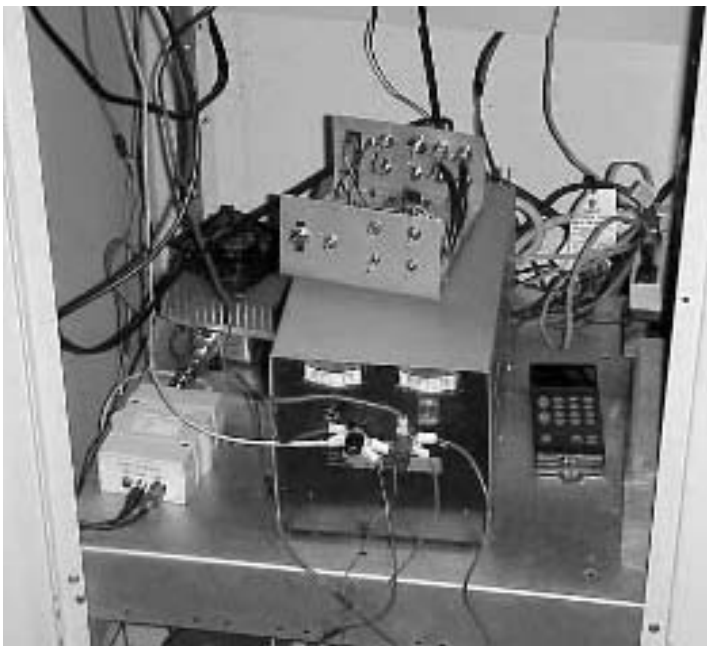
(2) Dennis, KC8LZK, installing commercial General Instruments exciter (red video modulation meter visible) in ATV cabinet. Thanks also to Tom, N8DGD, for procuring this cable industry castoff for us. The Teltec 150 watt sync tip final amp with blue front plate is also visible on top shelf.

(3) Ron, K8DMR, and Dave, KF8QL (on top), installing 1/2" hard line on ATV transmit (downward pointing rub cage) on August 3rd. The receive rib cage (upper rib cage) already employed hard line but the transmit antenna had been getting by with 9913 since it was originally put up. A run of 1/2" hard line was also connected to the club's tri-band Comet in the center replacing the 9913 used there as well. The 23 cm vertical is right behind Dave at the top.

Thanks to Abe, W8HVG, from the IRA and Chuck KA8IBY from the 147.72 Central MI Amateur Radio Association for the hard line and some of the connectors. Dennis, KC8LZK (working the ground crew), fabricated the rest of the hard line connectors.

(4) Close-up showing General Instruments exciter and PC Electronics driver amplifier in die-cast box. High power Teltec amp sitting on filter at right. Fans key on with repeater.

Large Aluminum box on which Teltec amp rests is one of 4 VSB filters we use (in addition to SAW filter inside exciter). Old VOR (video operated relay) circuitry contained in box under driver amp but now replaced by Intuitive Circuits ATV controller donated by KF8QL.



(5) Video ID generator with cover off. Driver amp power supply and auxiliary 23 cm transmitter and amp to allow reconfiguring repeater from in-band to cross-band operation with 439.25 input and 1252 FM output also shown at far right. Main power supply (for Teltec) is a 75 amp Astron supply

The 23 cm transmit has currently been replaced by an additional repeater input port at 1290 MHz using K8DMR's

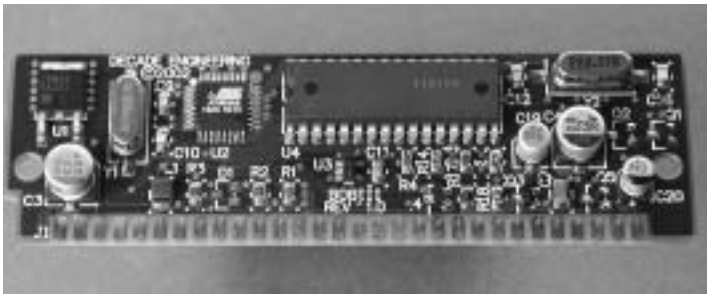
Bensat receiver. This allows users to watch their own signals with a minimum of self interference as well as enable possible remote ATV receive sites in the near future with 23 cm links back to Red Cross. (We currently have permission from TV-8 for an ATV receive site at their Oakwood Manor roof "Storm Team 8" weather radar site. This site has a great shot towards Chicago.)

(6) Upper VSB (normal) and lower VSB (alternate) 70 cm receivers, new uP based controller, VSB filters, 70 cm receive voter and an off-air monitor TV, all located on accompanying rack or on top of transmitter cabinet. The 23 cm receiver was absent when this picture was taken as we were transmitting on 23 cm as well at that time.

A single 4 pole DCI bandpass filter (435-445 MHZ), notch filter tuned to 444.4 MHz (the W8DC repeater's output frequency) and a GaAs-FET preamp is common to both LSB and USB receivers. The preamp output is then split and input to separately tuned 7 pole VSB filters, one for each receiver. The video outputs key the video-operated relay in the controller (next to the off-air TV monitor) with priority given to the upper VSB receiver (black box on top of unused 2 mtr amplifier on middle shelf) and for many users this gives the highest resolution video and best color. However this receiver is automatically disabled when 442.175 is active using a dedicated Fm receiver (also on the middle shelf) tuned to that frequency and control circuit added to a PC-Electronics VOR. Special notch filters (bottom shelf, beige colored unit) are stagger tuned across the low end of the 440 FM repeater band and work to reject interference from any and all FM repeaters to the lower VSB receiver (that receiver is in the Al box sandwiched between the notch filters and the blue LSB VSB filter).

ATVQ

BOB-3 New Product Announcement October 1, 2002



Decade Engineering announces BOB-3, their third-generation video on-screen display (OSD) module. BOB-3 automatically generates video or genlocks to incoming video and superimposes characters. The new function module efficiently adds video character display features to a wide variety of products, such as security & surveillance systems, remotely piloted vehicles, and video inspection systems. TV-based information displays and electronic signs using BOB-3 often out-compete high density LCD solutions.

BOB-3 is controlled much like a serial printer, through an RS-232 style interface at speeds up to 38.4kbps. It requires only DC power, data, and composite video I/O connections, but adds variable transparency and other optional features with outboard circuitry. BOB-3 sports the same 30-pin SIMM form factor as Decade's previous BOB-II module, and is largely upward compatible. Functional enhancements include: higher display density of 40x17 characters, vertical scrolling, and a stand-alone option for fixed video reticle and source ID applications. In addition to 254 ROM characters, a large set of 63 RAM characters is user-definable, for advanced pseudo-graphics and non-English language applications. In support of this feature, Decade offers a free BOB-3 Font Editor program for PCs.

NTSC and PAL versions are available from stock, with SIMM sockets and aggressive OEM pricing. Single BOB-3 modules sell for $99.95. The BOB-3 Application Guide and Font Editor program may be downloaded at www.decadenet.com.

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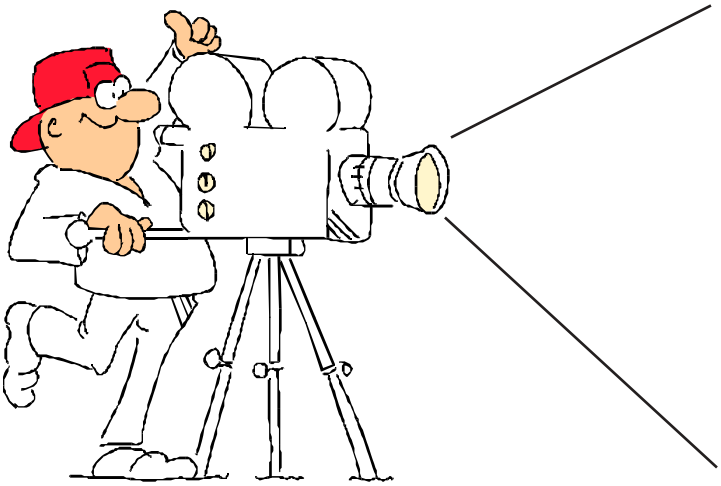

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A New ATV mode - EBE ??

by Jim Korenz - N8PXW - Email: n8pxw@@yahoo.com
3144 Lake Center
Uniontown, OH 44685

OK, now you're asking yourself, what is EBE? I know about EME, but what the heck begins with "B". Well, how about Blimp Bounce? Yeap, we reflected ATV at 2.4GHz off the Goodyear blimp. I don't know how well other blimps will work, but the Goodyear blimp is painted with many coats of reflective aluminum paint. Its relatively slow speed makes it easier to track than most flying objects.

A short history may be in order. A couple of years ago a group of local hams bought the Wavecom units when Radio Shack had them at closeout prices. We modified the transmitters by removing the attenuators and adding ERA-5 amplifiers to boost the output power to 20 to 60 MW. We were impressed that we could receive P5 pictures 3 to 5 miles line of sight using only a 3 ft dish with a coffee can feed at the transmit end and with an unmodified receiver and its patch antenna. We then started talking about what else we could do with this power and signal-to-noise ratio. Since we are about only 3 miles from the Goodyear Blimp Base 1 at Wingfoot Lake near Suffield, Ohio talk soon turned to the (highly unlikely) possibility of bouncing ATV signals off a blimp in flight. We decided that a good place to start would be to try reflecting signals off stationary objects. A prominent water tower in the area was selected, with a path length of about 2 miles. A fellow ham, Phil, WB8AVD, lent 2 Andrews 2.4 GHz grid antennas, each with 24DBi gain, for the experiments. While we got P5 pictures line of sight at 1.5 miles, we had no hint of video off the water tower. Oh well, back to the lab. Phil suggested that we try one of his "SmartAmp"s to boost our power. The amp was rated at 0.5W at 2.4GHz when used in wireless data links. We measured 250 to 400MW when we drove the amp from our modified Wavecoms. OK, back to the test range. Still no picture, but I think that I saw some video, or at least some noise reduction, when I pointed the receive antenna at the tower.

Well, what next? Wait a minute. I think I have a 13LNAHK preamp kit from Down East Microwave. After a quick search, the amp was found. Bench testing showed it to have a gain of 17DB at 2450MHz. Now for the field test. Yes, we have video off of the water tower!! Not quite enough for a stable, synced picture, but definitely video with very little noise. OK, now we are ready for the "real thing". As luck would have it, the 65th All American Soap Box Derby was only a week or so away. The blimp was seen in previous years to slowly circle the hill during most of the race. This should be an ideal situation for the proposed "blimp bounce".

It rained early the afternoon of Jul 27th, 2002, so we didn't

leave till after 2:00PM. Bob, WB8OVQ, set up the transmitter in the Lockheed-Martin parking lot, southwest of the Derby Downs Hill. I setup in a baseball diamond off Triplett Blvd, northeast of the hill. We verified that there was no direct path. As luck would have it, the blimp departed the area just as we arrived and setup. While we waited and hoped that the blimp would return, we decided to test the equipment by trying a "bounce" off a building to the west. Yes, the "haunted laboratory" gave a stable, synced, color picture that faded in and out. It was locked about 30% of the time, being stable for 3 to 5 sec at a time.

After what seemed like an eternity, actually about 20 to 30 min., the blimp returned. It then began a series of low, slow, circling passes over Derby Downs. Bob radioed me that he was following the blimp with his transmitter. "Do you have a picture?" "Wait a minute, let me aim the antenna." When I looked down at the TV, there was a stable picture, P5. "Yes, it works." "We did it!" "We've got a picture off the blimp!" The picture was in for only about 5 to 10 sec, then the antenna had to be aimed at the blimp, but there was no doubt that it came from the blimp. We followed the blimp for about 30 min, then it left for the day. Friends were impressed, but asked "Did you tape the video?". Well, no. In the rush to load the equipment: the 12V TV, the receive preamp, the Wavecom unit, the battery pack, the grid antenna, the tripod, and all the cables, I didn't remember a VCR.

Besides, I was running everything on a 12V battery, and I don't have a 12V VCR. Well, maybe next time.

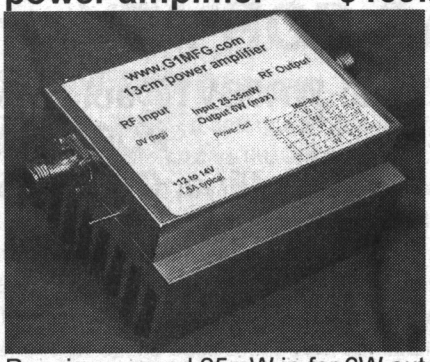
As it turned out, Goodyear was going to christen a new blimp Thursday, Sept. 5th, 2002 and there would 4 blimps in the air at the same time for almost a week! What a break! We could do blimp bounce off 4 blimps! Well, it wasn't quite as good as it sounded. The 4 blimps did fly in formation, but they were only in the area for takeoffs in the morning and landings in the evening, and then only for about 30 min. Anything we got this time would have to be quick. We found out that blimps were going to takeoff at 8:00AM on Sat. morning the 7th. This time I brought a VCR and an 120V inverter to power it. Bob borrowed a camcorder that had a microphone, so this time we had audio, and a zoom lens for blimp closeups. This series of attempts were quite a bit harder, since the blimps didn't follow a tight, preset path, but we did get creditable video from all four. Out of about 40 min, we probably have 3 to 4 min of viewable video and sound, some with 3 blimps in the picture.

In summary, it is possible to bounce FM ATV at 2.4GHz off of stationary and (large, slow) moving objects with less than 0.5W of power over short distances (1-2 miles). Experience with this system has shown that this is probably close to the lower limit of operation. Farther distances and smaller targets would most likely require substantially more power.

The authors (experimenters) WB8OVQ, Bob Warner and N8PXW, Jim Korenz wish to thank all those who helped us in this attempt. Special thanks go to WB8AVD, Phil Bresky of Skylan, who loaned us the Andrews 26T-2400 grid antennas and the SmartAmp power amplifier. We wish to thank our "camera men" KC8SUI, Rick Smith and N8JLQ, Carl Hervol, who showed up to watch and photograph the blimps and were drafted into service.

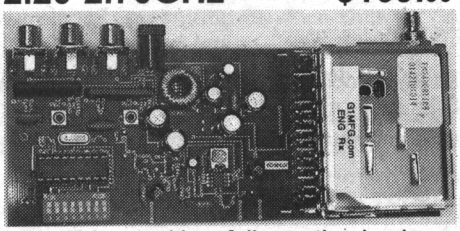
ATVQ

6W 13cm high gain power amplifier $469.99



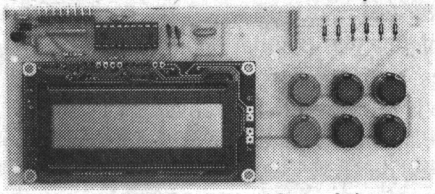
Requires around 25mW in for 6W out, typically gives 5W from our 13cm Tx. Runs on 12-14V. Fairly broadband - covers whole 13cm without re-tuning. Built, tested and aligned.

'ENG' FM TV receiver 2.20-2.70GHz $109.99



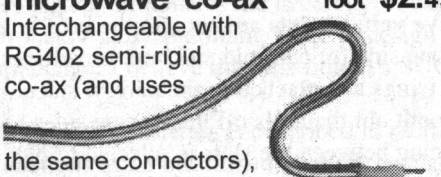
Incredibly sensitive, fully synthesized, receives 2.2-2.7GHz in 2MHz steps. Covers a lot of the outside broadcast frequencies, video senders and lots of other interesting stuff. All other specs similar to our 13cm Advanced receiver. Runs on 12-18V DC. Built & tested.

"ENG" LCD receiver controller $89.99



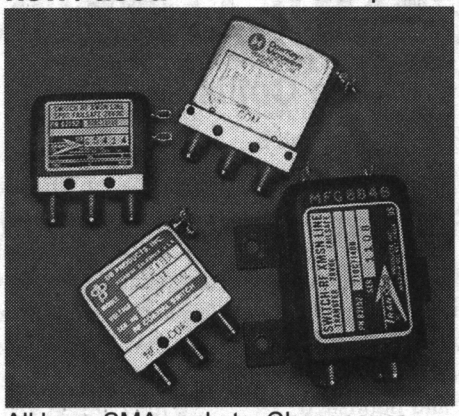
Connects to either our 13cm Advanced or ENG Rx. Receive frequency range 2.2-2.7GHz in 125kHz steps. Adds 10 memories plus memory scan and band scan modes. Built & tested.

Quickform 141 microwave co-ax foot $2.49



Interchangeable with RG402 semi-rigid co-ax (and uses the same connectors), but is far more flexible and easier to use. Good to 18GHz. Shipping $1.50 (any length).

Microwave coax relays new / used from $49.99



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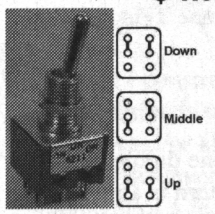
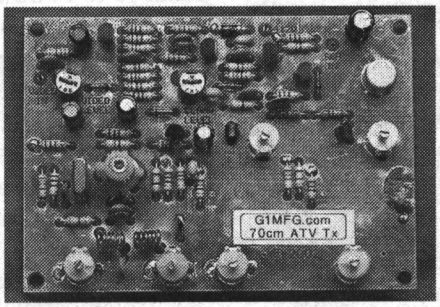


70cm AM ATV Tx $144.99

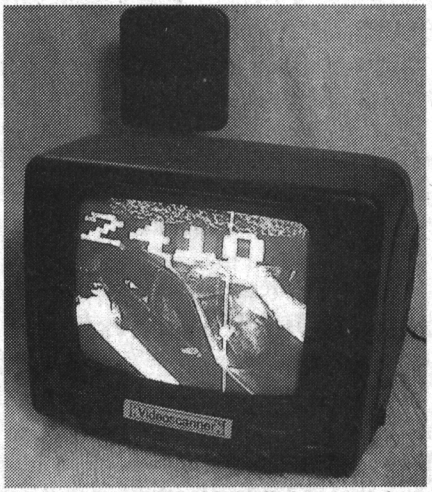


Transmits 435.5MHz DSB AM, 50-100mW output. Crystal controlled - other frequencies are available by arrangement. Runs from 12-14V DC, supplied built & tested. ~2.8"x3.9"

70cm 10W amp kit $159.99

This PA kit gives around 15W peak sync up from our 70cm Tx. Requires 0.5°C/W heatsink (not supplied), and runs on 12-14V at about 5A.

Scanning microwave FM TV receiver $294.99



5" mono monitor with built-in scanning receiver for 2.3-2.5GHz FM video. On-screen frequency display (while scanning), very sensitive, built-in patch antenna. Demodulates 6MHz sound. Runs on 12-14V DC @ 1A, includes cigar lighter power lead. Built & tested.

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LET'S EXPLORE HORIZONTAL OMNI ANTENNAS FOR ATV

By Mike Collis- WA6SVT - Email: WA6SVT@aol.com
POB 1594
Crestline, CA 92325

Regular Featured Column!

In the last issue of ATV Quarterly we explored vertical omni antennas for ATV use; I hope you all enjoyed it! Many areas of the country use horizontally polarized omni antennas for ATV. Several types of antennas will be discussed and an easy to build slot antenna design by Art Towslee WA8RMC and published back in a previous issue of ATVQ will be featured.

Horizontal omni antennas fall into the following basic designs:

1. Stacked Dipole
2. Big Wheel
3. Halo
4. Egg Beater
5. Zig Zag
6. Slotted Waveguide
7. Slotted Pipe

Crossed Dipole Arrays:

A pair of dipoles mounted in a cross and with one dipole phased 90 degrees away from the other dipole. The pattern is almost omni with slight nulls at 45 degrees to the dipoles. The gain is -3dB as compared to a single dipole. Multiple sets of crossed dipoles spaced 1 wavelength apart will achieve gain over a single dipole. We will refer to set as a bay. Two bays will give unity gain and four bays +3 dB, 8 bays +6dB etc. Each bay needs to be fed in phase for radiation on the horizon. To achieve down tilt (elevation beam tilt) each bay is fed slightly off phase and the amount of tilt is dependent on the amount of phase shift over the length of the array. The slight nulls at 45 degrees from the dipoles can be reduced by rotating alternate crossed dipoles by 45 degrees.

Big Wheel Arrays:

A modified design to the crossed dipole was done by Dave Clingerman W6OAL several years ago that eliminated the phasing harness between the crossed dipoles, reduced the four nulls, and increased the gain by about 2.5 dB for each bay. Three full wave loops arranged 120 degrees apart with the loop wires coming strait out from the hub then curving in an arc 120 degrees around a circle that looked like a wheel with three spoke sets. Two bays of big wheels spaced one wavelength apart and phased together will give about 2.5 dB gain over a dipole. A four bay set is good for 5.5 dB gain. Downtilt can be achieved in the same manor as for the dipoles. It should be noted that this applies for phasing vertical dipoles as well. A pair of adjustable small discs is used between the top of the loops fed by the center conductor of 50 Ohm coaxial line and the bottom of the loops to match the antenna to 50 ohms.

Halo Arrays:

A 1/2 wave loop open at the far end and tuned with adjustable disks and usually fed by gamma matching at the closed end. The Halo has fewer nulls than crossed dipoles and similar gain. They can be stacked into multi bay arrays as discussed for the above arrays.

Egg Beater Arrays:

Crossed full wave loops fed 90 degrees apart with the feed point at the top or bottom of the loops. The gain is about 1.5 dB better than the crossed dipoles. Each set of loops can be stacked as discussed above.

Zig Zag Panel Arrays:

This antenna is fed with balanced feed with a wire or rod bent in a zig zag pattern about 10 wavelengths long from end to end with the feed point in the middle. The antenna is usually mounted 1/4 wavelength in front of a reflector panel. Each panel has about 13 to 14 dB of gain and has a cardioid pattern. Usual practice is to mount four panels 90 degrees apart around the supporting mast or small faced tower sections for 7 to 8 dB omni gain. Additional bays can be stacked above each other for more gain. The bandwidth of this array is very wide covering the entire band plus. This antenna was popular on some UHF broadcast TV stations. In cases where close spacing of ATV repeaters or line "A" issues where it is desired to null coverage in one or more directions and have a smooth pattern over the desired coverage area, this antenna would work great. This can be done by deletion of one or two panels with an increase in gain in the desired directions.

Waveguide Slot Arrays:

Popular in microwave repeaters and beacons, a rectangular waveguide is excited with a probe 1/4 wave above the grounded end (normal waveguide end cap to coax adapter) or fed directly with waveguide. 1/2 wave vertical slots are cut into the broadside of the waveguide, one side for cardioid and both broadsides for omni pattern. Small wings are attached to the narrow sides of the waveguide to smooth out the nulls off the narrow sides of the waveguide. The spacing between the slots is selected to put all slots in phase. A slight phase shift can be added to beam tilt the array.

This antenna is end fed and as such the elevation beam is tilted as the frequency is changed (same affect as end fed collinear verticals).

Slotted Pipe Arrays:

This is the featured antenna in this review. A pipe or tubing about the same size as the diameter of a 1/2 wave dipole wrapped around in a circle with a 'two wavelength' tall slot and fed in the center of the slot with 93 ohm coax (RG-62). The slotted pipe makes a rugged antenna with a skull shaped pattern. Each bay will give about 5 dB of gain on the side with the slot. The gain is reduced by 1.5 off the back and two -2 dB nulls left and right of the back lobe. This antenna is very popular with UHF broadcasters and they obtain a smoother pattern by placing each bay at 90 degree azimuth turn from the bay below with a minimum of four bays needed.

A skull pattern generated by one bay has about 5 dB. If it was possible to make it omni the gain would be about 3 dB. The bays need to be mounted end to end with no more than 1/10 wavelength separation between slots, or each bay is getting out of phase and loss will occur. Horizontal reflector grid about one wavelength wide and mounted on the back side of the pipe opposite of the slot opening will give higher gain and a 180 degree pattern. The reflector can be bent at different angles to change the beamwidth in the azimuth plain. Two bays can be fed with equal lengths of 93 ohm coax to phase the bay together. Other impedance coax can be used with 1/2 wave or multiples thereof (remember to take the velocity factor of the coax into account). As with any array changing the phase of the current in each bay can give beam tilting to the elevation pattern.

OUR FEATURED ANTENNA!

A DUAL SLOT OMNIDIRECTIONAL ANTENNA FOR ATV REPEATER USE
By Art Towslee WA8RMC

Do you need a horizontally polarized omnidirectional gain antenna for 427 MHZ? Perhaps not, but that was exactly what was needed for the new ATCO repeater in Columbus Ohio. I was faced with the task of designing a mechanically strong antenna for our use. Now it would have been easy to just "throw money at it" and buy an antenna for our needs except for three main reasons: 1) no money 2) I don't trust ads that say "estimated gain ..."3) A commercial horizontally polarized omni pattern antenna doesn't exist (TV broadcast excepted). Actually item #1 technically eliminates the necessity of exploring items 2 and 3. Probably most important, I like to design things like this-it's a challenge. I believe that this time it's SUCCESS!!!

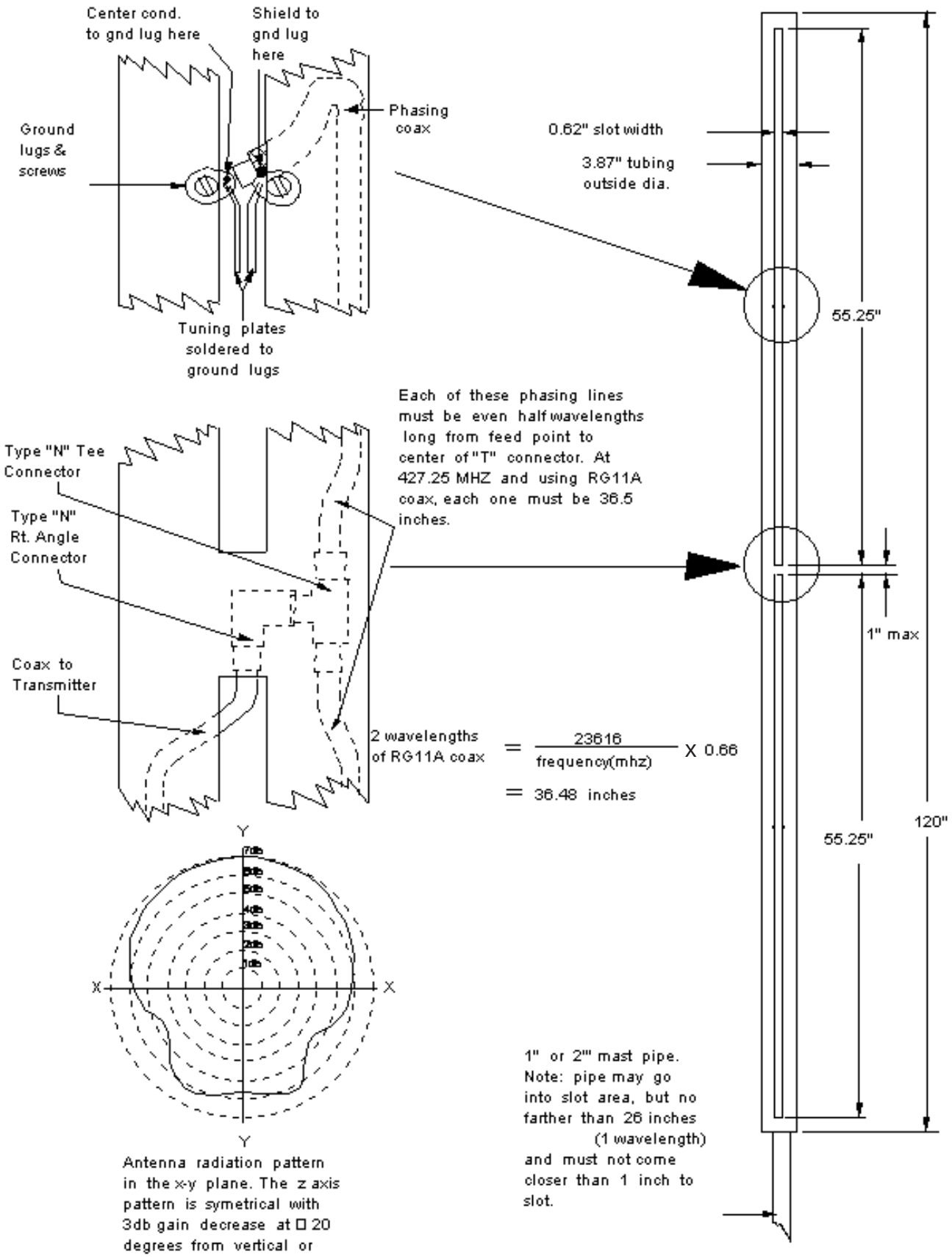
A single slot antenna is described in numerous publications and functions as an infinite number of circular dipoles stacked in the vertical plane. It works most efficiently at 427 MHZ when the overall diameter is about 4 inches and the length of the slot is 2 wavelengths long. With those dimensions, the feed impedance is somewhere around 100 ohms. (The feed impedance figure was determined by experimentation because several articles claim anywhere from 200 to 100 ohms). I tried several impedance matching sections until the SWR was at minimum. Considerable testing was done to verify that the single slot design was optimum before starting the dual version. When finished, an actual gain of 5 DB was obtained with a circular pattern to within 1.5 DB. The gain at the sides was down about 1.5 DB and rear gain was down 1 DB. Further testing was not able to improve upon this. There was always a condition where a more circular pattern resulted, but at the sacrifice of frontal gain so I stopped there and feel that it is optimum.

The addition of a second slot was not as straight forward as one may think. First, how far apart vertically should they be? Contrary to recommendations published for "stacking" the slots, 4.5 to 6 inch separation is not good. I found that gain dropped off noticeably after a separation of only 2 inches. I settled on a 1 inch separation which was the minimum practical distance and still be able to rotate them. For the record, no noticeable gain reduction occurred at 1 inch separation but started falling off at about 2 inches and was reduced by about 1.5 DB at a 4 inch separation. When we think about the reasons for this it seems that since the ends of each adjacent slot are the same phase and polarity ANY separation would tend to distort the pattern.

The way I constructed the slots allowed me to rotate each about the vertical axis to see if intentional misalignment would help the pattern. For all practical purposes, the slots want to be aligned. However I found that in my case at least, a slight misalignment of a few degrees helped the pattern slightly. A slight increase in gain of a few tenths of a DB was obtained but certainly not significant enough to cause one to intentionally construct the antenna to adjust for this. Even if you did desire to build the antenna this way, some good antenna measuring equipment is needed to be able to measure it.

The feed harness turned out to be quite simple. Since each slot had a feed impedance of about 100 ohms, two in parallel would exactly match a 50 ohm transmission line provided that each phasing line to the center was an even multiple of a wavelength (including the velocity factor of the coax). Note that the impedance of the phasing lines do not matter because they are exact multiples of a half wavelength. I realize this but found that RG11/U cable (75 ohms) was better by about 0.5 DB than Andrew 1/2 inch Superflex 50 ohm line even though the Andrews line had lower loss! I have no explanation for this because I ran out of line lengths and patience way before I stumbled upon the answer. Oh, by the way, for those of you that are saying you forgot the decoupling sleeve that's always required when you connect a balanced feed point to an unbalanced line, I didn't. I tried it and found no noticeable difference either way, so I left it off. Any guesses as to why this is so?

The final array as shown in the detail produces at least 7 DB of gain over a dipole with about - 2.5 DB on each side and -1.5 DB



Antenna radiation pattern in the x-y plane. The z axis pattern is symetrical with 3db gain decrease at □ 20 degrees from vertical or horizontal axis.

on the back. I don't like the side gain reduction but could not find any way to improve it without significantly sacrificing frontal gain. (When installed, we'll put the forward gain in the direction that does the most good). Final tuning is also required to both maximize gain and produce the lowest SWR. Two metal 1/2" x 1" tabs at the feed point spaced about 1/8" apart provided the required capacitance. Note, however, that slightly different slot widths will require a different capacitance. It is possible to construct the antenna with a slot so narrow that too much capacitance exists to start with. The addition of tabs would only make it worse.

I hope that my experiences and tests reported here will help someone else trying to build a slot antenna "from the book".

Follow-up:

The following is an excerpt from a letter I wrote to a fellow ham regarding the slot antenna. It contains some of my thinking at the time and is in addition to the article I wrote in 9/22/97, Art Towslee WA8RMC.

My ultimate goal for designing a slot antenna was for our club ATV repeater. After considering a number of designs, I settled on a slot antenna because of its inherent ruggedness for the top of a 47 story building in downtown Columbus Ohio. A dual slot was selected because, after experiments, I found the feed impedance of a single slot to be about 100 to 125 ohms. Therefore a dual (two singles in parallel) would be about 50 ohms and could be connected to a 50 ohm transmission line without impedance matching problems.

1. The length of each slot should be about 2 free space wavelengths long. This is not critical and could be shortened by a couple of inches or so before any noticeable gain reduction occurs. I'm told (I haven't verified this) that the design length could be 1 wavelength long and can be lengthened to up to 2 wavelengths for some additional gain. Lengthening it beyond that point would produce no further gain increase so that is why we stop there.

2. The slot width is a function of the diameter and should be widened as the diameter increases. I've found that about .062" is about right for a 3.87 " outer diameter. However, cut it a little narrow and test the antenna for gain and SWR. If 5db can't be obtained (single slot) and 7 1/2 bd (dual slot), add small capacitance tabs at the feed point(s). If this makes it worse, widen the slot width about 1/16" and try again. The slot width is proper when the addition of a small amount of capacitance (1-2 pf) makes it better.

3. The diameter, I was told, is supposed to be optimum at about 3" OD but I haven't found any substantiation for this. I've built one with 3" OD pipe and one with 3 1/2" OD pipe and both worked great. In fact, the one with the 3 1/2" pipe produced about 1/2db higher gain (8db for a dual slot).

4. I've found that 3" or 3 1/2" nominal aluminum electrical conduit is almost perfect for a dual slot design. They measure about 3 1/2" and 3" OD respectfully. They are 10 feet long and are threaded on each end which makes connection to a mast easy. Simply screw on a cap on the top end and a reducer on the other to reduce it to the mast size of your choice. This pipe is about 3/16" thick so it's fairly heavy. Use good hardware to attach it. Price for a 10 foot section is about $40.00.

5. If you build the dual slot version, the phase harness length is somewhat critical. Use any impedance coax but be sure that each leg is a multiple of an electrical wavelength long. Best approach is to cut them a little long. Assemble it and test for the resonant frequency. Adjust the length accordingly. An error of 1/4" will change the resonant frequency about 5 MHz!

6. I've found no need for an unbalance sleeve (Pausey Stub) at the feedpoint. Although in theory it is necessary to use a balun to match a balanced feed to an unbalanced line, I found no measurable sacrifice by not doing so here. If you find otherwise, please let me know.

7. Dual slot antennas must have the bottom of the top slot within an inch or so of the top of the bottom slot to prevent any gain loss. The commercial examples that show a single slot antenna mounted over the other creating a dual slot design are wrong.

8. I've found that all slot antennas have a gain notch at about 4 o'clock and again at about 8 o'clock. I measured this to be about 2 Db. If you find a way to eliminate it, or explain why it's there, please let me know.

9. Measurement details. I have tested all of my antennas by supplying a 100-200 MW RF source fed into a gain antenna at one end of my yard with the test antenna (slot) about 75 feet away at the other end. I use a Boonton RF voltmeter connected to the slot with a cavity between to keep out unwanted local RF in the business band. Using the test antenna in receive mode seems to work best. Also it is helpful to angle the transmit antenna up from the ground to eliminate ground reflections. (That's why a dipole antenna can't be used at the source end.) If you do angle the test antenna up, remember to angle the slot for it must be perpendicular to the RF path.

I hope that I've given you some ideas to help your slot antenna construction. The construction article that I did was first published in our ATCO newsletter in July 1993 and re-published in the winter 1994 issue of ATVQ magazine.

ATVQ

HABITAT SkyLab

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Herington, KS. September 7, 2002 10:00 a.m. the launch clock had been put on hold with T -5 minutes. Last minute work on the capsules, at a feverish pace, was causing the delay. While the instrument capsule was prepped and sending valid data. The communication test capsule was not completely ready to go, on it's high cold trip.

Both capsules on the HABITAT SkyLab system would travel to near space (last recorded altitude would be 89,631 feet) and back. The success or failure of the mission would depend on these two small capsules.

Unknown to mission control, ham radio operators all across the central US were standing by to participate in this simple experiment. At the last minute, the mission "GO" notice was sent to several email lists and on various nets. Would the hams be there?

Various team members were completing their tasks so the launch countdown could resume. The Project Traveler team and their capsule were ready. Since it was going to be a dual launch, neither team could launch until both teams were ready.

Activities were taking place all around the Herington Airport. The Open House had caused quite a crowd to join the festivities. The spectators knew the one launch crew was late, and wondered how long before lift-off.

At one point a small commotion caused me to lift my head from the capsule to see a sky diver landing near by, with another higher in the air above him. No time to enjoy the activities outside launch prep. Back to the capsule...

Charlie was finishing up the insulation experiment on the coaxial cable from the MFJ roll-up J-Pole antenna connected to the communications experiment capsule. We had encased the same type antenna in Teflon tubing to protect it from the harsh environment we were about to subject them too. Our coax had suffered damage in the past, we wanted to try and, minimize if not, eliminate it this time.

The capsules were given one last ground test; by Will, Bob and Andy, to be sure the electronics and communications gear were working. Dean prepared the mission commander and verified the compartment was secure.

Mission control authorized fuel movement. The vehicles were readied for fueling. Both teams were given the go ahead to begin fueling. HABITAT SkyLab, being the larger vehicle and causing the delay, decided to make up some lost time in fueling. The valves were opened; fuel began freely flowing from the fuel tanks to the vehicle at an accelerated speed. Constant attention focused on the pressure gauges, connections, fuel lines and storage tanks. Project Traveler was also fueling their vehicle.

Final weights and calculations determined there was not suffcient fuel for the HABITAT SkyLab to carry the ATV video equipment. Unfortunately no pictures from the capsule on this flight. The flight would be limited to the two primary missions, tracking/recovery and communications.

Both vehicles were fueled, loaded and ready. The announcements rang over the PA system. The launch countdown resumed: 5 4 3 2 1 LAUNCH!

Away they streaked into the hot summer sky! Data stations began reporting data from both flights.

"Initial report: about 990 fpm accent rate" from a voice over my shoulder, a member of the Wichita BEARS .
"But for which flight is that?" was my immediate question?
"Project Traveler" was the reply.
"How about HABITAT?"
"I'll run some more calculations and get back to you ASAP" he said matter of factly.

A group of the Wichita BEARS wanting to start their own Near Space program, joined the other two groups to see a launch, flight and recovery first hand. They jumped right in and provided valuable assistance. Their efforts made the flight the success it turned out to be.

Wide eyes and excited voices from the crowd followed the two latex weather balloons as they jetted skyward. Both, with their parachutes and capsules suspended under them, drifted north along side the runway.

Immediately after lift off, the communications capsule payload came alive with activity. Launch teams were some of the first to trigger the 2M simplex repeater on the HABITAT SkyLab communications capsule. More and more stations began to ID. More distant stations, farther and farther away, joined in as the antenna was raised into the air.

If you have not experienced a simplex repeater it can be confusing. It is basically a carrier operated digital recorder. When it hears a carrier it begins to record the audio for about 30 seconds maximum. If the carrier drops or the time runs out it then switches automatically to transmit and repeats what it heard. The mode of operation is not a true repeater. Once it finishes transmitting what it recorded it sends a courtesy tone, and the cycle repeats.

If you are close enough to hear the transmitting station, most have a tendency to have a simplex conversation. Distant stations only hearing the output from the simplex repeater can not tell when a station is talking. There is silence if no station is talking and there is silence when a station is being recorded. The secret is to think of timing. Once the tone is heard it is ready to record another 30 seconds. If transmissions are kept short, several can get in during a cycle.

It became obvious, if one of the stationary operators could be a Net Control, perhaps more order could be brought to the operation. I requested a volunteer. Brian KS0BS replied and took over. As I listened I remembered one of our objectives was to try and set some of the distance QSO records. I didn't recall what they were but felt sure we could do well enough to be included in them.

I was not able to turn my attention to the flight and start getting ready for the chase and recovery. Will's mobile station was tracking very well. He has a very nice set up. He became our official tracking and

recovery team of one. As the other two chase teams in our group worked to overcome equipment problems. Will kept us in contact with our capsules.

Bob and Andy were working on Bob's backup computer. His primary suffered a crash.

Dean, Charlie and I worked on equipment in and on our vehicle. Dean drove, Charlie navigated and I worked the radio while trying to get my tracking station online.

The Project Traveler teams began their chase. Some of the Wichita BEARS remained at the airport to provide public information and status. At least one of their chase teams fell in with us to chase our flight. I'm not sure if others joined Project Traveler.

There is something natural about High Altitude Balloons teaming up with General Aviation. We again want to thank the Management and members of the Herington Airport for letting us participate at their facility. Last year during the first Great Plains Super Launch, GPSL 2001, when our capsules became lost, several of the pilots from the Herington Airport conducted searches for our missing capsules. The airport manager asked if we could launch a flight for their open house. Weather caused us to cancel, not knowing the facilities and the travel time.

This years when GPSL 2002 needed an alternate launch site due to changing weather, I remembered Herington Airports support. A call to the manager got a positive response. We were able to launch 8 balloons from 6 groups across the country this year at the Herington Airport for GPSL 2002. HABITAT SkyLab flew our own balloon, actually two - a tandem arrangement, instead of riding, and falling (smile), with another group last year (that is how our capsules came to be lost). Meeting and talking with the airport management and people, it was decided we would launch for their open house this year, regardless of weather (within the rules of course). Personally I, and I think everyone, am glad we did.

We successfully set new distance records on this flight. We are recorded in second place (1st for a simplex repeater) with a distance of 478 miles. Also now in third place at 460 miles. I think this qualifies as a great success. The forth place record is like 322 miles, so we got a pretty good showing for it, even delayed, short notice and all.

I think you will find working the simplex repeater, or any of the balloon radios, not only fun but challenging. While our antennas were supposed to be vertical, they changed a lot. Due to capsule spin, swing, and the changes that does to the antenna, not to mention the weak signal (we normally use about 300 mw radios), I wonder about the similarities to other weak signal work. I have not worked Meteor Scatter myself but have heard recordings of it.

The thought comes to my mind; why not PSK or other modes? I am not experienced in these modes either but would be interested in discussing it. Or just experiment. Since the simplex repeater is a digital recorder, we have successfully worked packet though it. Perhaps on a future flight we could dedicate a time slot for other modes than voice. My radios, right now, are FM. If there is interest maybe we could set up like the first 10 seconds of a minute to say cw, that would be 20 second - 10 xmit 10 rec or some combination that makes sense. Then perhaps a segment of PSK and the remainder of voice.

I think if we would plan this and then get the word out early we should be able to have even more fun!

Currently we are planning a flight in October. Please let me know if you would be interested in participating in a future flight.

Both groups successfully flew and recovered their capsules safely on September 7, 2002. More info on this and other flights can be found on each teams web site. HABITAT SkyLab maintains it's own private email list for notices and other flight information. We will soon be adding a section for the mission commanders. Glory volunteered, and served proudly, for this mission in honor of the upcoming September 11, 2001 memorials.

Currently a few pictures and other data is online from this flight. Soon a audio recording of the record QSO(s) will be online as well as a log of the stations that checked in. Unfortunately net control had a computer malfunction that lost some contact information. If you made contact but don't see your info let me know and I'll get it updated.

73 de Don
Founder HABIAT SkyLab (High Altitude Basic Investigating Testing And Tracking)
web: **http://habitat.netlab.org or email: ka0jlf@earthlink.net**

ATVQ

Central Illinois - St. Louis Area Amateur Television Club

The 17th Annual Central Illinois - St. Louis Area Amateur Television Club banquet will be held on November 10, 2002 at the Ariston Resturant in Litchfield, Illinois. Last years attendance was almost 40, and they anticipate greater participation this year.

In additin to the dinner, program and speakers, they will again have a prize drawing.

Information from:
Scott Millick, K9SM
President

ATVQ

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ATV in AIRCRAFT

By Tom O'Hara W6ORG

ATV is being used more and more by RACES and emergency service groups for remote damage assessment. Besides mobile and portable ATV units on the ground, on site commanders as well as those at the emergency operations center (EOS) get a better overall impression of the incident scene from airborne ATV. It is also just lot of fun to watch the video of the local area provided by hams who have ATV in their aircraft. There are a few special considerations for ATV in aircraft however.

I first put ATV in a Los Angeles County Sheriff's helicopter for the Pasadena, CA Police to enable them to get a birds eye view of the chaotic traffic flow from the New Year's Day Rose Parade to the Rose Bowl in 1968 (QST May 1968 page 106). The cars leaving the beginning of the parade route would all clog the few streets that lead down into the Rose Bowl two miles away causing grid lock. As a result of being able to see the big picture (pun intended) and better direct traffic, Pasadena PD bought their own helicopters the following year and our ham group was out of that facet of Rose Parade communications. The set up was quite a kludge with an ATV converted tube type RCA CMU-10 FM voice transceiver, DC/AC inverter, power supply and antenna all strapped down in a victims basket of a Bell H47.

Later, in 1988, I installed 434 MHz ATV in my Enstrom F28C helicopter to demonstrate the feasibility of transmitting earthquake damage sites back to the Los Angeles County Emergency Operations Center. Today the LA County Sheriffs RACES can operate ATV in 4 helicopters and many mobile ground units including one portable repeater. There are also over two dozen city and county emergency service ham organizations in Southern California that use mobile and airborne ATV as part of their emergency communication operations.

For my initial helicopter flights, the video was noisy and quite a puzzle since the noise did not occur on the ground even with the engine and rotor turning. Finally I realized that the braid of the RG58 coax to the antenna would vibrate enough to change contact resistance between the strands and that would show up as an AM modulation from SWR change. The solution is to use Teflon double shielded coax with tight braid or aluminum foil. I suggest RG400, which you can possibly get from companies that do mobile cellular phone installations, or RG162.

Antenna type and placement is another unique problem. What works best is a stiff quarter-wave spike on the belly. Ground planes have about a 15 degree up-tilt in the radiation pattern. Placing the antenna on the belly places most of the power toward the ground rather than outer space if mounted on top of the aircraft. Longer gain antennas have narrower vertical pattern lobes which can cause signal drop out nulls sooner as the aircraft increases its banking turns. A vertical omni is the simplest and will give the best over all coverage in flight. Many are commercially available. A horizontal omni is very difficult to mount since it must be placed away from the aircraft metal skin so as not to affect its pattern and it will have much more wind resistance.

The landing gear on fixed wing or the skids on helicopters can also put significant nulls in the antenna pattern. Before flying an actual demonstration or event it is best to find out where your radiation peaks and nulls are by having a ground station describe the signal strength changes to you on two meters as you make flat 360 degree turns. That way when you are shooting a significant scene you can fly your position relative to the receiving station, as well as sun angle, for the best video at the receive site.

For the antenna, I used 1/8” diameter solid brass rod about 6.5” long and then trimmed for minimum reflected power. However you will have to find a ham friendly FAA certified radio shop to install your antenna or sign off your work to be legal. They may be resistant to installing antennas that are not made for aircraft. There is, however, a company who does make FAA certified antennas for the ham bands - Comant, (562) 946-6694. They have both 2 meter and 440 MHz antennas. I have not tried it but I would think that one of their 2 meter quarter-wave antennas would also work as a 3/4 wave on 70cm ATV. If it does, then you can use just the one antenna and coax for both bands using a Diamond MX72N duplexer.

The FAA says that anything that is fastened to the aircraft must be approved and signed off. To get around this, the ham equipment can all be put in a plastic milk crate or opened suitcase and strapped into one of the seats. This way it can be easily placed in any aircraft, as long as it has the antenna installed, put in other vehicles or taken portable. A gel-cell can be used to power the equipment or a cigarette lighter plug into the vehicles power if available.

I suggest the TC70-20S ATV Transceiver for aircraft use. First, 20 watts is a power level that is generally not too high to bother the avionics gear as long as there is some antenna separation - this should be checked out on the ground before taking off.

Second, the 5 amps of current is not too high to draw down a 17 Ah gel-cell all the way on a typical flight or be of any real concern to the aircraft’s total currant draw or wiring. Also the amount of heat dissipation does not require a fan or will adversely raise the cockpit temperature. If the aircraft power is 28 volts a series regulator on a heat sink is still not so big as would be required if a higher power amplifier was added.

Third, the line of sight snow free picture dx with 20 watts p.e.p. on the 70cm band is about 33 miles given the quarter wave spike and a 9 dBd Diamond F718 vertical omni on the ground. You can get farther if you have line of sight and a higher gain beam that can track the aircraft, or you don’t mind a little snow. At 5000 feet above ground level, the RF horizon over flat terrain is 100 miles. Your 20 watts on 70cm will give a P3 to P4 picture (P5 being snow free - see 1996-2002 ARRL Handbook page 12.47) to an ATV station with a 14 dBd beam. See ATV DX Variables - download from page 3 www.hamtv.com. If the aircraft is not line of sight, the scene can be taped with a camcorder and then the aircraft can climb up to line of sight to play the tape.

Note that the lower the frequency, the farther the distance given the same power and antenna gains due to antenna area. Therefore, the 420-450 MHz band is suggested rather than 902-928 MHz, which would give half the distance, or 1240-1300 MHz at 1/3. However you could make up some of the difference on the higher bands with higher gain beams. Every 6 dB increase doubles the distance for the same signal level, or improves the picture one P unit at the same location. The other bonus of using the 70cm band is that the ATV can also be picked up on a cable ready TV tuned to cable channels 57 through 60 with just a good outside 70cm antenna. This makes it easy to have additional TV reception at other emergency service sites with little expense or effort.

It is best to check with local ATVers to find out the coordinated ATV frequencies so that you do not interfere with other band users or unknowingly key up a local ATV repeater. Using the local two meter ATV coordination channel while airborne helps with minimizing interference, getting signal reports and sparking interest. With only two ATV channels in the 70cm band available in any given area, and emergency operations sometimes taking quite a while, coordinating on two meters can go a long way in keeping other users patient.

Don’t forget to identify every 10 minutes and at the end of a transmission by voice on the sound subcarrier or call letters on the video. You can make a card up with fat black printing of your call and the two meter frequency you are coordinating on. Intuitive Circuits makes a video overlay board which will put your call ID info on the screen for 5-10 seconds every 9 minutes to automatically satisfy the requirement. We also stock their boards that will

overlay location and other information directly from a GPS receiver as well as your call to satisfy the FCC legal requirement.

Fourth, you many think you only need a transmitter in the aircraft. But a receiver is a big help to see if anyone else is on that you might interfere with before you transmit from your big antenna in the sky. Seeing the other ATV stations during an emergency operation will keep you from transmitting over them as well as giving you a better feel for what is going on. Which ATV station is transmitting is usually coordinated on two meters but seeing the station actually turn off before you turn on looks much better especially to the non-hams on the ground watching. The Rose Parade ATV had as many as 17 stations to coordinate.

The little liquid crystal TV receivers are perfect for portable use. Some TV's even have a video input which can be plugged into the transceivers monitor output so you can see your own camera video for fine video gain adjustment rather than rely on comments from the ground. The TV / monitor also makes it easier to see what you are shooting versus the eye piece types of camcorders. You may have to make and tape a cardboard hood around the screen to block direct sunlight from obscuring the image.

Only cameras with solid state pick up devices should be used. The old vidicon cameras will get streaks or burns that can be permanent if accidentally pointed at the sun. CCD or MOS cameras or camcorders work the best. A camcorder will allow taping at the same time or playing back at a later date. See our catalogue for small color cameras, also ATV Research (800-392-3922) has a good catalogue with a variety of cameras. Hand holding the camera will dampen out the aircraft vibration rather than affixing it to a tripod or aircraft structure. Start with wide angle shots and practice tracking the scene on the ground in the monitor with slow steady hand movement. As you get the hang of it, you can try the zoom, because you don't want those on the ground to get air sick watching your video.

Hearing the two meter FM voice coordination channel versus the aircraft communications in the cockpit can be a problem, especially if headsets are normally used such as in helicopters. Your aircraft radio shop can set you up with a pair of jacks for an external radio to select from your aircraft audio panel but the cost and complexity may be more than you want to do. I use an earpiece under the headset plugged into my HT or transceiver. That way the pilot does not have to listen to the ham chatter or juggle the relative volumes, but the camera operator can hear both the aircraft communications and or intercom as well as coordinate with the hams on the ground via the two meter transceiver. An ear piece can also be plugged into the TV to hear the ATV audio as well.

Noise canceling or Low impedance dynamic directional mics work best for ATV in high noise environments. Do not use the omni mic that is part of the camcorder; you will pick up too much noise. It is tempting to close talk and shout into the mic so make sure you have turned the mic gain down low enough that your voice does not come out all distorted. The mic audio controls are on the front of the ATV transceiver but you will have to go inside most two meter transceivers to make the adjustment.

Airborne ATV can be a lot of fun as well as serving as a valuable eye in the sky for emergency service commanders. Transmissions must be controlled by a licensed amateur and transmitted to at least one other amateur who is receiving the transmission - no one way transmissions or broadcasting per 97.111 and 97.113. One word of caution however, Amateur radio frequencies cannot be used for normal police, fire, CAP or government use except for RACES drills for emergency preparedness. See FCC Rules part 97.407 which limit operation to one hour per week, no more than two 72 hour drills per year and must be approved by the areas RACES authorities. It is tempting for some of these agencies to want to use ATV as an inexpensive tool for their normal business rather than their own microwave frequencies and type accepted equipment after they have observed what hams can do at public service events and for ARES communications drills.

See you in the air, Tom O'Hara, W6ORG

TV Technology For Non-Techies
Three Paths to Quality

Part II

by Henry Ruh - AA9XW - Email a9xw@cs.com
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How do I know my video is good?

Despite the advances in camera technology, much of what you see on your TV looks good because of automatic gain devices. The TV set or monitor, the VCR, the camera, all have chips in them that monitor the video levels and make automatic adjustments. Your ham TV transmitter does not. Your ham TV amplifier does not. So while it may look good to you, it may be awful to those watching.

Cameras:

Just because it has a lot of automatic features, does not mean you are making a good picture. Sitting in front of the camera with a window or light behind you will still not make a good picture. The contrast levels and what is necessary to compose a well lit, well defined picture have not changed. The automatic features help keep images in focus, and to some extent, adjust the iris to limit the amount of light. They do not compensate for a poorly lit subject, uneven lighting, excessive or insufficient contrast levels, and other basics that affect how well the camera reproduces the subject.

VCR's have circuits that crank up the color, contrast and modify other technical parameters. If you were to look at the raw video vs the automatically adjusted video, you could see the changes the circuits are making. There is also an audio AGC circuit in the VCR that adjusts the input level to try and provide a constant level, but there are limitations to what these can do. It is not unusual to listen to a non professional tape and hear the noise floor pumping, the excessive compression and distortion that is now a part of the recording because the source was not properly adjusted.

The TV set and monitor also have circuits that modify the incoming signal. Low burst will cause the color circuits to increase color saturation, there are automatic hue circuits to make everyone the same flesh tone. Most TV sets are grossly miss adjusted to meet what the owner thinks is good video. Still today, I have walked into homes with expensive home theater systems only to see the picture so badly adjusted you wonder why they bothered to spend the big bucks in the first place.

Setting a standard

Nearly every TV set is shipped with the various video controls set to a factory starting point. It is not the same from manufacturer to manufacturer. Some prefer pastel color levels, others more saturated. Even worse, the on screen bar graph does not have a "calibration" point indicated. So except for assuming that center line is "standard" there is not much help to the user. In fact using the center of the bar on some sets does not produce a professionally calibrated display, it simply meets the factory preset levels.

It should be no surprise that the sales department likely had a hand in selecting the "factory standard." The public "taste" varies country to county. Orientals prefer more subtle colors, north/south America prefer more saturated colors. Europeans prefer brighter pictures. Nearly everyone equates higher contrast ratio displays as better than real life equivalent contrast ratios.

If you have a nice broadcast or industrial type monitor, there are knobs with presets, or detents that actually represent the correct settings with a new picture tube. As the tube ages, several changes occur that make these incorrect over time. If you are using a consumer TV set, you have no such reference points. You could invest in an expensive color gun analyzer from Sencore, B&K or others to adjust the color display, but you might get frustrated with the amount of changes you will have to make.

Phosphors used in TV CRTs have varied, and are today different from set to set. There are actual SMPTE phosphors that were selected to reproduce a specific color spectrum as "standard." However, none of the sets you are likely to own are built with SMPTE standard phosphors. The manufacturers have also changed the color spectrum based on their market perceptions and sales. The move to "richer reds, greener greens etc" was the public way of saying that the picture tube has been modified to reproduce pictures as the manufacturer thinks is better and you may enjoy more so you should buy their set. A color monitor set to official SMPTE color, saturation, gamma and contrast ratios is rather dark and dull compared to your home TV. It actually looks "flat" and unsaturated. But it does represent the actual video in harmony with what the camera is actually generating. And when generating a picture, this is what you should actually see. If you are watching the transmission, it is perfectly acceptable to crank up the contrast and saturate the colors till they bloom, if that is how you want to watch the video. But it is not the way to SEND the right video so the home viewer can tinker.

Starting here:

If you have a "pro" monitor with gun switches and actual adjustments for black, white, gamma and other settings, you can approximate the correct settings. You can also modify a regular TV set by adding gun switches, (so you can individually turn off red green and blue). It will be harder to "remote" the bias and gain controls for each color channel, and likely not worth the effort. Many sets no longer have any controls, as they have another automatic circuit IC that monitors the CRT and adjusts the bias and beam currents to try and maintain a good looking picture as the tube ages. You can get as ambitious as you want, but once set, there should not be a need for regular adjustment. You might have access to one of the older "Color analysts" or CRT monitoring testers built for TV service shops to align older sets. The flea markets usually have one or two as independent TV service shops close down their service departments and sell off the test gear.

The first step is always to black and white balance the picture. As the CRT ages, the phosphors wear out at different rates. This usually means a gradual loss of blue, and the picture becomes more red/green, and then more red over time. If the picture "blooms" and you see color, usually red, streaking off saturated objects, the CRT is shot. Don't even bother to tweak it.

Using a black and white stair step signal, (usually 9 to 11 steps) the darkest bar should be set to where you cannot tell from a distance if it is truly extinguished or just barely illuminated. Most new color bar generators have three black strips in the lower right portion of the picture. There is one at "black", one strip that is 2 IRE units above black and one 2 IRE units below black. The black level is adjusted so you cannot see the -2 bar, and the 0 bar is barely visible and the +2 bar is easily seen. Now adjust the brightness and contrast so that the lightest white bar is clearly brighter than the second highest. If you cannot see a clear difference, the brightness is too high. All 9, 10 or 11 steps should be clearly discernable. There is a function called gamma. On a scope, the steps should be equal distant apart from black to white. This is neutral gamma. It represents the true logarithmic response of the signal. If the lower (black) areas are compressed and then the white steps are stretched, the gamma is too dark (negative) and if the black steps are larger than the white, the gamma is too light (positive). If you have a chart that has two sets of reflectance chips running opposite to each other, they form an X on the scope. The crossover point should be at 50 IRE units, white at 100 and black at 7.5 or 10. This is a gamma of .5 If the cross over point is lower, at 40 ire units, that is a gamma of .4, likewise .6 if the crossover is at 60 units. Different gamma can be selected to compensate for example, for the gamma of film, or to simulate different lighting conditions - night scenes shot in full sunlight!

Color balance means the black and white and the levels in between should have no color tint. If the blacks are tinted, you need to adjust the bias (usually) so there is no color tint. If the whites are tinted, usually I is the beam that needs adjusting. This is also when you may notice that the registration, or overlap of the R G B guns is out of alignment. A registration chart is used to align the sweep circuits to get best overlap so all the scan lines are "white" and there are no visible red green or blue lines.

Now switch from the gray scale to color bars. Depending on the phosphor formulations and age, the magenta bar should be neither red nor blue, and the yellow bar should be neither red nor green. If the colors are simply all not correct here is how to align the tint and saturation controls. This is where the RGB gun switches help. The first step is to turn off red and green for blue only. You should see four blue bars with black bars in between each.

The tint control is adjusted until all four are equal, especially the two in the center that are the critical adjustment. When you are satisfied that the blue bars are all equal, turn off blue and turn on red. There should be four red bars on the left half of the screen. Adjust the saturation (color) control until all four are equal brightness. Now turn on all three guns. You should have a nice color bar signal on the screen.

There is a "gotcha." TV signal generators and TV stations use the I and Q matrix for making color. Many TV sets use R-y and B-y matrix to decode the signal. There is an axis shift between the two. The R-y B-y system is cheaper to manufacture, and it compressed the red color tints and stretches the green-yellow tints. Supposedly it was done to make less color difference as seen, in saturated reds and flesh tones, where the eye is more sensitive, and shift the color phase change into a wider "color space" in blues where our eyes are less sensitive to color change. If you look at the two side by side, you can easily tell the difference and see how the manufacturer is cheating you out of a good picture using R-y B-y.

Your monitor is now adjusted and becomes your "house" standard reference. Super glue or lock the controls! You now have a starting point so you can adjust your video sources for accurate reproduction.

More next time.

Henry - AA9XW

ATVQ

My Impressions Of GPSL 2002 (the Great Plains Super Launch)

By Paul Verhage - KD4STH - Email: paul.verhage@boiseschools.org
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In a word, Wow! I never thought I could pull this off successfully. One reason I did is because of the great help and support I had. Without the help of my mother, Mark Conner (N9XTN) and Ralph Wallio (WØRPK) GPSL 2002 would not have been the success it was. One other thing that helped was the fact there was a history behind GPSL 2002.

Pre-GPSL

Two years ago, in June 2000, I made a trip to Manhattan, Kansas (from Idaho where I teach) to visit my parents. I still had email addresses from my balloon buddies in Kansas and Nebraska, so I proposed we launch a balloon during my visit. We launched our balloon from the Johnson Near Space Center, about ten miles south of the town of Manhattan. This is the same location that I launched balloons when I was the program manager of KNSP. I had lost my main tracking capsule back in Idaho, so my science capsule hitched a ride with Mark Conner's (N9XTN) tracking capsule. My capsule carried a Basic Stamp and was programmed to position a 35mm camera and take pictures at fixed intervals. Launch day was covered with dreary overcast skies. Because of the clouds, the photographs looking downwards were pretty much useless. That is except for one or two that showed Mark's capsule below my capsule and a jet contrail still thousands of feet lower. There were other photographs taken that showed the balloon expanding as it ascended to over 90,000 feet. The chase of this flight went well and chase crews were about 1/2 mile away from the capsules as they dropped out of the low cloudbank. I suppose this launch could be considered the first GPSL.

GPSL 2001

In the spring of 2001, when we were considering another balloon launch during my annual visit to my parents, it was decided we should try for a record number of launches that summer. When planning to break a near space record, there's only one source to go to, and that's Ralph Wallio (WØRPK). He informed us that the greatest number of known simultaneous launches was two. So Mark Conner (N9XTN), Bill All (N3KKM), Don Pfister (KAØJLF), and I (KD4STH) began planning for at least three simultaneous launches. The near space programs involved were TVNSP from Idaho, HABITAT and NSBG from the Kansas City area, and NSTAR from Nebraska. This time we determined we needed a name for the launches because Kimbra Cutlip of Weatherwise magazine asked to cover the launches. It was Bill All (N3KKM) who came up with the name Great Plains Super Launch, or GPSL, because of the number of balloons we were attempting to launch. GPSL 2001 was a wonderful success, with three balloons being launched and two being immediately recovered (Bill's was recovered a few days later). HABITAT and NSBG shared a ride on a balloon while NSTAR and TVNSP each took their own ride on a balloon. During its descent, Bill and Don's capsules ran into a problem and stopped sending us packets. Mark's capsule was the first one capsule recovered. The owner and his family of the wheat field that the capsule landed in were fascinated by what had happened. My capsule was recovered second in another cut wheat field. This time however, the landowner didn't care one bit about what we were doing. So we retrieved the capsule and left the field to find Bill. Bill searched for a couple hours in the area we predicted it would land based on its last known altitude and descent. Sometimes we get lucky making this kind of prediction, as when Mark predicted a capsule's recovery location to within less than a mile of its actually landing location. This time however, we were unsuccessful. We met Bill on the road after his search and headed off to lunch and have our film processed. Midwestern farmers tend to be a friendly bunch, and when one farmer found a capsule in his field a few days later. Bill left a phone card and a phone number on his capsule, in case something like this should happen. A few days later Bill made arrangements to pick up his capsule. Ms. Cutlip wrote an excellent article on GPSL 2001. See Weatherwise, November/December 2001, pp. 14 - 23.

GPSL 2002

Well, we had launched three balloons the previous GPSL, what could we attempt this time? How about twice as many launches? And how about adding a symposium to the launch and making GPSL 2002 into a two day event? My mother arranged for GPSL 2002 to use the Hemisphere Room at the Kansas State Library (the Hale Library). Ralph maintained the webpage for

GPSL 2002 so that everyone could keep up to date on the plans for GPSL. He also kept me on my toes, so I didn't forget anything. Mark started the Yahoo Groups email list and researched things like available motels and rates that guests could use. By the time I left for my summer vacation, everything for GPSL 2002 had been arranged except for food trays.

Officially, GPSL 2002 started on Friday morning, 5 July 2002. Unofficially it began Thursday evening when several of us met for dinner in Manhattan, Kansas. Present at dinner was Bill Brown (WB8ELK), probably the first person to launch a balloon carrying amateur radio gear. Since his flight in 1987, a lot has changed in ham radio. Now we send GPS receivers and TNCs on our balloons to make tracking and recovery easier. But in the early days, it was all done with direction finding. This can be tough when you consider that a balloon may reach altitudes in excess of 90,000 feet and land over 100 miles away.

Ralph Wallio, W0RPK, fine tines projector. Photo by Marty, WA0GEH

Friday morning began with several near space programs setting up displays about their programs. The variation in the design and construction of near space capsules is amazing. What these programs are planning and accomplishing is even more amazing. Ralph Wallio (WØRPK) MC'd the symposium. He began with introductions by the 25 attendees of GPSL 2002. Next the near space programs present discussed what they were currently working on. Several videotapes were shown. Some videos were of near space launches; some were of newscasts about launches; while others were actual videos taken from near space. After the morning presentations, we headed over to the Ramada Inn's restaurant, the Gold Fork. They couldn't seat all of us at one table, so we occupied four tables in one corner of the restaurant.

Marty Griffin, WA0GEH, talks tracking and recovery - Photo by Sharon Griffin

The afternoon presentations were more technical. Presentations covered the range of topics from, Early History, Meteorology, Tracking and Recovery Procedures, Advanced Projects, and Airframes and Avionics. I'm currently putting together proceedings from the GPSL 2002 symposium. So if you'd like more information on the presentations, please email the author. At the close of the presentations, attendees decided the launch time for Saturday morning. The author is accustomed to launching balloons at the break of dawn, before the sun has a chance to create surface winds too high to safely launch balloons. This meant a launch at 6:00 AM, which means we had to arrive at the launch site before 5:00 AM. This was fine with the author (and probably others), but not with the majority of the attendees. So it was decided to arrive at the launch site at 7:00 AM and try to launch by 9:00 AM. Because of winds aloft that were not cooperating with a launch from the traditional Johnson Near Space Center, it had been decided several days earlier to move the launch site out to the Herington municipal airport. This required we drive more than an hour from Manhattan to get to the launch site. No doubt that added to the desire to launch later in the morning.

Attendees - Photo by Mike, KD7LMO, ANSR

After Friday afternoon's presentations, GPSL 2002 attendees drove to the Sirloin Stockade in Manhattan for dinner. At dinner Bill Brown (WB8ELK) was presented a plaque declaring

him the Father Of Amateur Radio high Altitude Ballooning. Bill's first flight occurred on his birthday in August 1987. Since his first launch, Bill has launched over 200 balloons carrying some form of amateur radio. And here I thought I was doing pretty well at 33 launches in five and a half years.

Kicking the helium around

Saturday morning couldn't be much better. There was a little haze in the sky that would limit our ability to see the balloons at high altitudes, but other than that, the morning was perfect. The surface winds were light enough that we were able to safely fill the balloons outdoors. Almost everyone arrived by 7:00 AM, but we didn't start filling the balloons until much later. Only the Herington Times covered the launch. Other local newspapers and television stations didn't even try to cover the launch. I'm sorry Mr. Harlan wasn't able top make it out to the launch. But unlike other media, Mr. Harlan did make the effort to cover the launch.

Bill Brown, WB8ELK

Paul Verhage, KD4STH

The only problem to occur that morning was when Mike Bogard's (KDØFW) balloon burst. His balloon was twenty years old and during the filling, began budging. Eventually the budge burst with a pop. Bill Brown (WB8ELK) must have been covered in latex, as he was beneath the balloon, holding it by the neck at the time it burst. Fortunately Zack Clobes (WØZC) had brought an extra balloon with him. It wasn't until after 9:00 AM that all the balloons were finally filled and sealed. After conferring with the balloon crews, we decided we were all ready for launch. A total of eight weather balloons were carried out to the grassy field near the tarmac. Once safely spread out, we formed a line about 200 feet long. The size of this launch made communications with all the balloon crews difficult. Before launch, every balloon crew manager indicated their readiness to launch by calling out either a GO or NO GO. There was only one NO GO, but it only took a few minutes to correct their lanyard problem.

Mark Conner, N9XTN, NSTAR

After a countdown from five, the balloons simultaneously took to the hazy Kansas skies. It was impressive to see all these balloons lift off at once. With the low winds aloft, we were in no hurry to start chasing after the balloons. After getting pictures of the launch crews, we headed out to the Herington Dairy Queen for refreshments and waited there for the first balloon to burst. Zacks' balloon was the first to burst, after having reached an altitude greater than 72,000 feet. Zack used a 600-gram balloon, so it's not surprising his balloon burst first and at the lowest altitude. EOSS's and TVNSP's balloons were 1200 grams

EOSS begins filling operations

Filling pilot balloon

each, so these two flights reached altitudes above 87,000 feet before bursting. Ascent times were only about ninety minutes and it took the capsules another hour to land. With APRS on the balloons and Kansas roads arranged in a grid with roads every one mile, the recovery of capsules went very well and fast. The capsule that took the longest to recover was Mike Bogard's (KDØFW) capsule. He didn't fly an APRS tracker; instead Mike flew ATV and a 6m repeater on his balloon. So recovering his balloon required fox hunting skills. Talk about the ultimate foxhunt! By 3:00 PM, all the capsules had been successfully recovered.

After recovery, most balloon crews headed to lunch at the Cracker Barrel restaurant in Junction City, Kansas, located almost one hour north of Herington. With over 20 people present, we swamped the restaurant. Stories and photographs were traded during launch. Everyone agreed this had been a great GPSL and were looking forward to next years. Next year's GPSL will feature contests. So if you like making predictions, chasing radios, or helping balloons make the highest altitudes, please join us for GPSL 2003. For the latest information on GPSL 2003, join the GPSL email list on Yahoo Groups.

Photographs in full color are available on line at:
www.eoss.org/ansrecap/thirtyone_to_sixty/recap58.htm
members.cox.net/mconner1/nstar.html
users.crosspaths.net/~wallio/gpsl2002.html

ATVQ

ATVC-4 Plus - Second Generation Amateur Television Repeater Controller

(248) 524-1918
www.icircuits.com

Intuitive Circuits, LLC
2275 Brinston Ave.
Troy, Michigan 48083

Description

Installing an amateur television repeater takes some real planning and quality equipment. “Thinking about putting up an ATV repeater” by Tom O’Hara of P.C. Electronics is a valuable document which discusses frequencies, propagation, site coordination, antennas, transmitters, receivers, and filtering. An important device that ties all this equipment together is the ATV repeater controller.

ATVC-4 Plus is Intuitive Circuit’s second generation Amateur Television repeater controller. We’ve spent years producing quality ATV products and really listened to what ATVers wanted in an inexpensive ATV repeater controller.

ATVC-4 Plus has many features including:

Five video input sources
* Four of the five video inputs have individual sync detection circuitry allowing for true priority base ATV receiver switching
* The fifth video input accepts video from any video id generator like the OSD-ID (PC)
* All five sources can be switched remotely via DTMF command

Four audio input sources
* All four sources can be mixed
* All four sources can be switched on and off remotely via DTMF command
* Line level and speaker level inputs are supported
* A jumper configuration allows for control radio monitoring over the ATV audio output

Non-volatile storage including
* ATV Transmitter hang-time
* Morse Code (CW) speed
* Morse Code (CW) repeater callsign
* Nine digit DTMF password
* Beacon mode status
* ATV receiver inputs allowed to key the ATV transmitter

Additional features
* Robust Morse Code (CW) telemetry feedback
* A beacon mode
* The ability to add dozens of video and audio sources

Specifications

Dimensions:	6” x 3.85”
Input voltage:	12.0 to 13.8 volts DC (200 ma max.)
Operating temperature:	-10° to +70° C
Microprocessor:	Microchip 16C62B-04I/SP
Video input sources:	4 sync detectable + 1 ID generated
Video level and impedance:	1 volt peak to peak, 75 ohms
Audio input sources:	4 line level + 1 control radio (DTMF)
Audio input levels:	0.1V to 4.0V peak to peak
Audio input impedance:	10K ohms
Control audio input impedance:	100K ohms
TX relay contact rating:	2 amps @ 13.8 volts
DTMF password:	0 to 9 digits. Valid digits 0123456789ABC*#

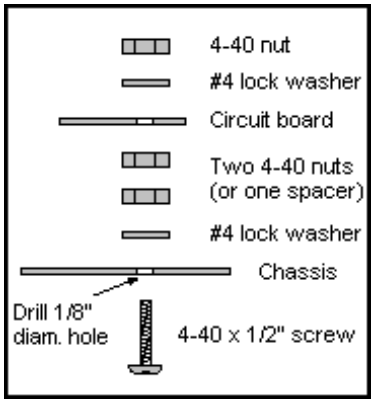
Installation

The following is the list of ATVC-4 Plus circuit board pads (places to solder wires to). Please follow common electronic safety precautions when soldering.

Pad	Attach To
Video In #1 (VID 1)	ATV receiver video output, repeater room camera, etc.
Video In #2 (VID 2)	ATV receiver video output, repeater room camera, etc.
Video In #3 (VID 3)	ATV receiver video output, repeater room camera, etc.
Video In #4 (VID 4)	ATV receiver video output, repeater room camera, etc.
Audio In #1 (AUD 1)	ATV receiver audio output, repeater room mic, etc.
Audio In #2 (AUD 2)	ATV receiver audio output, repeater room mic, etc.
Audio In #3 (AUD 3)	ATV receiver audio output, repeater room mic, etc.
Audio In #4 (AUD 4)	ATV receiver audio output, repeater room mic, etc.
Control Audio In (CTRL)	Control radio audio output
AUDIO OUT	ATV transmitter audio input
ID Video In (ID VID)	ID generator video output
VIDEO OUT	ATV transmitter video input
13.8 VDC +	Regulated +12 to +13.8 volt supply
13.8 VDC -	Ground from power supply
C1	Regulated + 13.8 VDC supply for the ATV transmitter (maximum two amps)
NC1	EMPTY
NO1	ATV transmitter DC input
C2	GND or +13.8 VDC (for the ATV amplifier trigger)
NC2	EMPTY
NO2	ATV amplifier trigger jack (for the ATV amplifier trigger)

Board Mounting

Mount the ATVC-4 Plus board into a shielded enclosure like the CAB 247 to protect it from RF. For each of the four mounting holes be sure to use two 4-40 nylon nuts or one 1/4” nylon spacer between the ATVC-4 Plus board and chassis to prevent the bottom of the ATVC-4 Plus board from shorting to the chassis.



Programming

ATVC-4 Plus has four on-board LED’s to indicate status. The green LED (D1) shows the presence of power and will remain on while power is supplied to the circuit. The yellow LED (D3) blinks during the power-up sequence and then will light whenever a valid DTMF digit is being decoded. The amber LED (D4) indicates when the video ID relay is energized and the red LED (D2) indicates when the ATV transmitter is active.

Programming ATV-4 Plus is simple process which allows the repeater owner to customize the repeater hang time, DTMF password, Morse Code ID message (up to 100 characters), and Morse Code speed (1 to 25 words per minute). The Morse Code ID message is required to meet FCC requirements by identifying the repeater every ten minutes during an active QSO and at the end of the transmission. Upon applying power to ATVC-4 Plus the yellow LED (D3) will blink ten times if a valid Morse Code message is stored in the non-volatile eeprom. If at power-up the yellow LED blinks twenty times then the eeprom is empty indicating there is no stored Morse Code message.

To enter the ATVC-4 Plus programming mode first apply power to ATVC-4 Plus. During the yellow LED (D3) blink sequence press and release the # key on a DTMF encoder source that is hooked to the control audio source (CTRL) input. While in the programming mode the yellow LED (D3) will stay lit except during a valid DTMF entry. Audio via the "AUDIO OUT" jack will also give important feedback. If there is any invalid entry the controller will restart the power-up sequence allowing you the chance to reenter the programming mode and try again.

Programming Steps:
1. Enter the programming mode (see above).
2. Enter the two digit repeater hang time (e.g 10). Valid entries are 01 to 99. The hang time is how many seconds the transmitter will stay keyed after the incoming signal is lost or DTMF command 00# has been received. Two beeps will follow indicating success.
3. Enter the two digit words-per-minute (WPM) Morse Code speed (e.g. 20). Valid entries are 01 to 25. This is also the speed at which all telemetry information will be sent from ATVC-4 Plus. Two beeps will follow indicating success.
4. Enter the Morse Code message (all are two digit entries) from the table below. Each Morse Code character entry will be echoed to "AUDIO OUT". Once done enter a 99. For example, 23 08 30 13 20 45 27 99 is the message "N8UDK/R".
5. Enter the number of digits the of DTMF password. Valid entries are 0 to 9. A DTMF password protects the repeater from illegal access. If 0 is entered then no DTMF password is required to access the repeater. Two beeps will follow indicating success.
6. The final step is to enter the actual password DTMF digits (if 0 wasn't specified in step 4). Enter the number of DTMF digits specified in step 4. Two beeps will follow indicating success for each digit.
7. At this point the yellow LED (D3) will turn off and you are exited from the programming mode.

For example after entering the programming mode 10 20 23 08 30 13 20 45 27 99 3 A B C would specify a 10 second hang time, 20 words per minutes CW speed, N8UDK/R is the Morse Code ID message, and 3 digit password of ABC.

Note: The ATVC-4 Plus normal behavior is to play the Morse Code message every ten minutes during an active QSO. Alternatively if you enter no Morse Code message (i.e. enter the two digit WPM speed followed by a 99) then the video ID source is used exclusively for repeater identification. A CW ID message is recommended.

Note: If a DTMF password was programmed then the DTMF password must be entered before each DTMF command below.

Morse Code character set:

0 = 00	A = 10	K = 20	U = 30	= = 40	AR = 50
1 = 01	B = 11	L = 21	V = 31	: = 41	SK = 51
2 = 02	C = 12	M = 22	W = 32	; = 42	SN = 52
3 = 03	D = 13	N = 23	X = 33	(= 43	SPACE = 53
4 = 04	E = 14	O = 24	Y = 34	) = 44	
5 = 05	F = 15	P = 25	Z = 35	/ = 45	
6 = 06	G = 16	Q = 26	. = 36	" = 46	
7 = 07	H = 17	R = 27	, = 37	' = 47	
8 = 08	I = 18	S = 28	? = 38	KA = 48	
9 = 09	J = 19	T = 29	- = 39	AS = 49	EXIT = 99

Sync Detect Frequency Adjustments

ATVC-4 Plus has four independent video sync detection circuits which allows the continuous monitoring of video inputs VID1, VID2, VID3, and VID4 for valid video sync. The frequency of each sync decoder is set by using a frequency counter connected to the corresponding test point. With no video connected carefully adjust each frequency pot to within +- 100 Hz of 15734 Hz for NTSC. This is done at the factory so no adjustment is normally required.

Pot	Adjusts	Test Point
R38	Video source #1 (VID1) sync detect frequency +- 100 Hz of 15734 Hz for NTSC	TP1
R51	Video source #2 (VID2) sync detect frequency +- 100 Hz of 15734 Hz for NTSC	TP2
R60	Video source #3 (VID3) sync detect frequency +- 100 Hz of 15734 Hz for NTSC	TP3
R69	Video source #4 (VID4) sync detect frequency +- 100 Hz of 15734 Hz for NTSC	TP4

Video Signal Sensitivity Adjustments

Each sensitivity pot adjusts how strong the corresponding incoming ATV receiver video signal is required to key the ATV transmitter. It is similar to a squelch knob on a radio.

Pot	Adjusts
R44	Video source #1 (VID1) ATV receiver signal strength sensitivity
R53	Video source #2 (VID2) ATV receiver signal strength sensitivity
R62	Video source #3 (VID3) ATV receiver signal strength sensitivity
R71	Video source #4 (VID4) ATV receiver signal strength sensitivity

Audio Level Adjustments

ATVC-4 Plus' four audio input sources AUD1, AUD2, AUD3, and AUD4 are mixable. The controller expects LINE level audio inputs (i.e. ATV receiver audio output or VCR audio output) so pads are available at each of the four audio inputs to insert a 100 ohm parallel resistor to knock down SPEAKER levels (like a 144.34 radio) to LINE levels. It is also important to remember when adjusting the audio balancing pots to verify the Morse Code ID can still be heard so the repeater maintains the FCC identification requirement and the CW telemetry can be reliably heard.

Pot	Adjusts
R39	Audio source #1 (AUD1) audio level
R40	Audio source #2 (AUD2) audio level
R41	Audio source #3 (AUD3) audio level
R42	Audio source #4 (AUD4) audio level
R43	Morse Code audio level

Jumper	Purpose
JMP1	If the left two pins of JMP1 are jumpered you will hear the normal audio in input (AUD 3) retransmitted through the repeater if setting A3 is on. By moving the jumper to the right two pins of JMP1 you will instead hear the control radio audio repeated. The purpose for the feature is to allow you to hear the control DTMF tones over your TV as well as the operator talking on the control frequency. Remember to also add the 100 ohm parallel resistor near the "CTRL" pads to knock down the SPEAKER level to LINE level.

Operation

There are three conditions in which ATVC-4 Plus will key the ATV transmitter:

1. A user enters 00* on the control radio frequency, which forces the ATV repeater to transmit. This allows the controlling of video and audio sources at the repeater site (e.g. a room camera). The repeater will remain on until 00# is entered.

2. Sync is detected on a video source which has been configured to allow the keying of the ATV transmitter. ATVC-4 Plus continuously monitors all four video inputs (VID 1 - VID 4) for sync from a valid video signal source such as an ATV receiver. If sync is found it then checks to see if activity on that specific video source is allowed to key the ATV transmitter (settings 01 - 04). For example if "VID 1" has an ATV receiver attached to it and "VID 2" has a link (e.g. Space Shuttle) ATV receiver attached to it then the DTMF commands 01* and 02* would allow activity from either receiver to key the ATV transmitter. When sync is detected on the Space Shuttle link ATVC-4 Plus switches to the "VID 2" ATV receiver video and "AUD 2" ATV receiver audio then keys the ATV transmitter. If at any point sync appears on "VID 1" then video (VID 1) and audio (AUD 1) are automatically selected because of the higher priority. If the "VID 1" source drops then VID2/AUD2 are switched back on with the Space Shuttle being shown once again.

3. When the beacon mode is enabled and the ATV transmitter is idle for ten minutes.

Regardless of the situation that keys the ATV transmitter, ATVC-4 meets the FCC legal requirements for repeater identification. Every ten minutes (when the transmitter is active) the Morse Code call sign identification message is mixed with the selected audio sources (avoiding QSO interruptions). The exception to this is if no Morse Code ID message is stored in the eeprom. If this is the case then every ten minutes during an active QSO the ID generated video source "ID VID" is displayed for ten seconds. Either way, at the end of a transmission the ID generated video source is displayed for the programmed hangtime with the optional Morse Code ID followed by the transmitter dropping.

Manual video source selection:
Manual video source selection can be performed at any time. The five video sources are mutually exclusive which means only one source can be selected at a time. The switching is done by sending a momentary DTMF digit 1, 2, 3, 4, or 5. (5 is the ID generated video). For example if there is a camera at the repeater site attached to "VID 4" then 00* would force the repeater transmitter on with the Video ID generator screen (VID 5) selected by default. Pressing 4 would show the attached repeater site camera (VID 4) and a 00# would drop the transmitter.

Manual audio source selection:
The four audio sources are selected (*) and unselected (#) via the DTMF commands A1, A2, A3 and A4. Unlike the video sources which are mutually exclusive, the audio sources can be mixed. For example if "AUD 1" has the ATV receiver audio attached to it and "AUD 4" has a radio tuned to 144.34 MHz audio attached to it then by sending A1* and A4* the ATV receiver audio will be mixed with the 144.34 audio. Adjust the audio in pots (R39 -R42) to balance the audio levels. Audio inputs 1, 2, 3, and 4 are LINE level inputs (i.e. ATV receiver audio output or VCR audio output). Pads are available at each of the four audio inputs to insert a parallel resistor to knock down SPEAKER levels (like our 144.34 radio) to LINE levels. So in the example above, an 100 ohm resistor would be inserted to the pads next to "AUD 4" to knock down the radio SPEAKER level to a LINE level. It is also important to remember when adjusting the audio balancing pots to verify the Morse Code ID can still be heard so the repeater maintains the FCC identification requirement and you can reliably hear the telemetry.

Beacon mode:
ATVC-4 Plus has a beacon mode which is activated and deactivated through DTMF command AB. Once activated (AB*), ATVC-4 Plus will perform the following five steps every ten minutes when the repeater is idle:

1. Switch to the video ID source (ID VID)
2. Key the ATV transmitter
3. Play the Morse Code repeater ID once
4. Wait twenty seconds
5. Drop the ATV transmitter

Telemetry:
ATVC-4 Plus' telemetry (status of the repeaters settings) can be requested via DTMF commands B0 through B5. The Morse Code telemetry information is sent over the ATV repeater audio (i.e. received on your TV). A Morse Code O (dah dah dah) is sent for settings that are ON and a Morse code F (dit dit dah dit) for settings that are off. For example if "B0", the beacon mode status, is requested then one Morse Code character will be sent. If the beacon mode is on then a dah dah dah is sent, otherwise the beacon mode is off and dit dit dah dit is sent. If "B2", the audio sources status, is requested then four Morse Code characters will be sent. Each one corresponding to the respective audio source 1-4 state.

Adding additional video, audio, and control sources:
There is a cost effective, scalable solution to increase the number of ATVC-4 Plus selectable video and audio sources as well as adding the control of an unlimited number of external devices such as repeater room lights, pan/tilt rotors, etc. The secret is to add independent DTMF decoder boards to the same control audio path and program ATVC-4 Plus with a password (more of a board ID in this case).

Here is an example to add 8 additional video sources to the repeater: Program ATVC-4 Plus with the single DTMF password of "C". Additional trailing DTMF digits can appended for additional security. A single DTMF-8 board will be our video switcher. It is programmed for mode 4 (mutually exclusive) with a password of 91. The eight NO (normally open) relays are wired to various video cameras, color bar generators, etc. The eight COM (commons) are tied together and connected to "VID 4" on the ATV-4 Plus. The control radio audio output, which is attached to the ATVC-4 Plus "CTRL" audio input, is also attach to the DTMF-8 control audio input.

To view the eight additional video sources enter the following DTMF commands:

* C00* forces the ATV transmitter on
* C4 selects video source 4 on the ATVC-4 Plus
* 91 1 through 91 8 switch the eight additional video sources
* C00# turns the ATV transmitter off

Remember this example could be expanded to add dozens of audio sources, repeater room control devices, etc.

ATVC-4 Plus DTMF Commands

DTMF	Latched settings - followed by * = on, # = off
00	Force ATV transmitter on (without need for incoming ATV receiver horizontal sync)
01	Allow sync signal of “Video In #1” to key ATV transmitter - CW (o)n or o(f)f ack follows
02	Allow sync signal of “Video In #2” to key ATV transmitter - CW (o)n or o(f)f ack follows
03	Allow sync signal of “Video In #3” to key ATV transmitter - CW (o)n or o(f)f ack follows
04	Allow sync signal of “Video In #4” to key ATV transmitter - CW (o)n or o(f)f ack follows
A1	Manual selection of audio source #1 (AUD 1)
A2	Manual selection of audio source #2 (AUD 2)
A3	Manual selection of audio source #3 (AUD 3)
A4	Manual selection of audio source #4 (AUD 4)
AB	Beacon mode - (see description above) - CW (o)n or o(f)f ack follows

DTMF	**Manual video source select (momentary press & release)**
1	Select video source #1 (VID1)
2	Select video source #2 (VID2)
3	Select video source #3 (VID3)
4	Select video source #4 (VID4)
5	Select video source #5 (ID VID)

DTMF	**Repeater telemetry via Morse code (momentary press and release)**
B0	Send on/off status of “beacon mode” (AB)
B1	Send on/off status of the four “allow sync to key” settings (01 - 04)
B2	Send on/off status of the four audio sources (A1 - A4)
B3	Play current sync status of the four video input sources
B4	Send repeater ID
B5	Send controller software revision

Trouble Shooting Tips

Problem / Solution

Green LED off (won’t power up)

Check Power supply output (12 - 13.8 VDC). Check polarity to ATVC-4 Plus board.

Unable to program or yellow LED doesn’t change state when DTMF tone is applied

Check “Control Audio In” (CTRL) polarity. Decrease volume of ATVC-4 Plus radio audio (possible over driving audio input). Increase volume of ATVC-4 Plus radio audio.

Incoming receiver video doesn’t cause ATVC-4 Plus to key transmitter Check that the appropriate “allow sync” 01-04 setting is on.

Check the corresponding Frequency and Sensitivity pots.

ATVQ

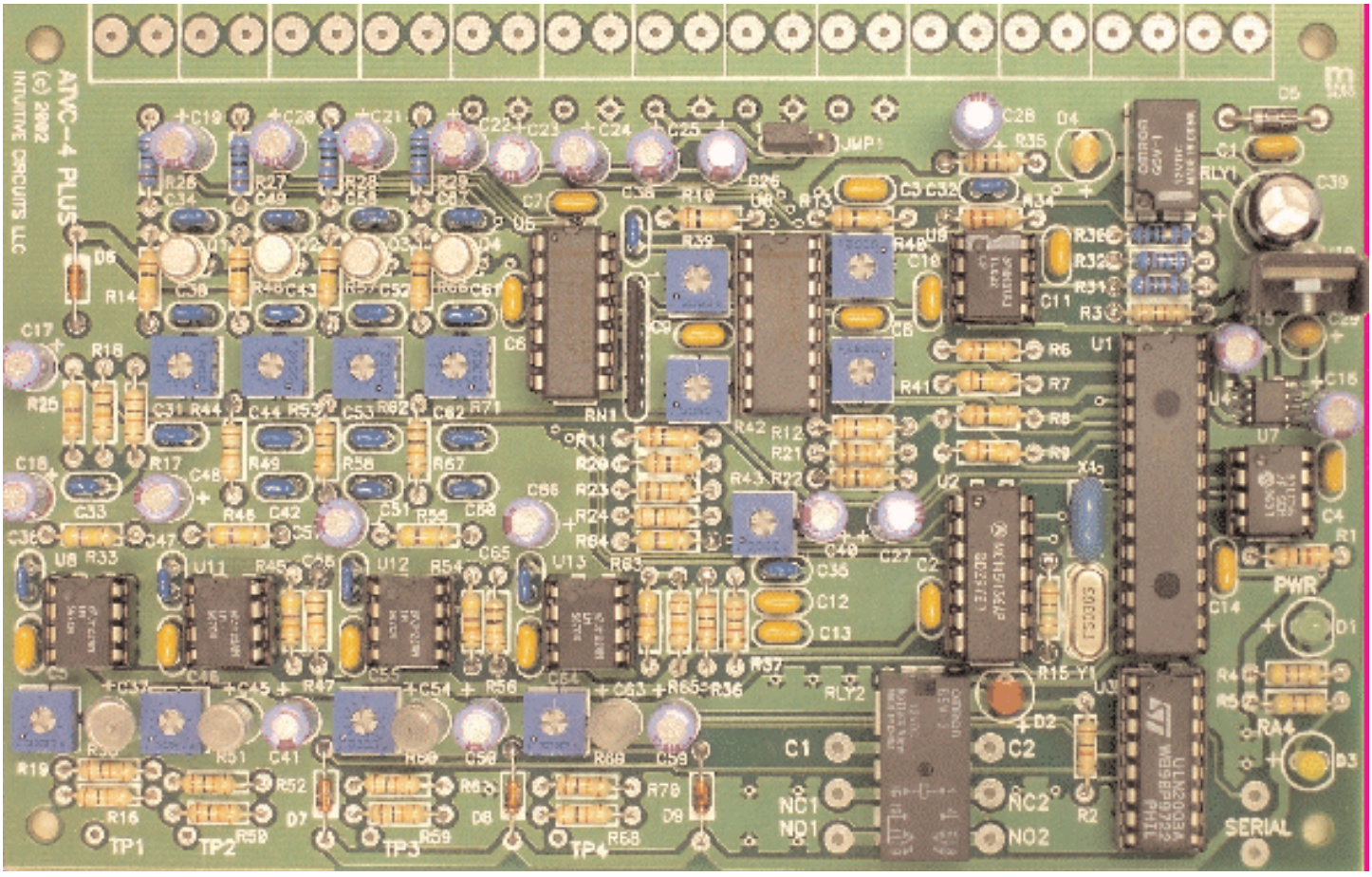


Fig 1.0 - Front view of the ATVC-4 Plus circuit board.

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IDing on R/C ATV

Minimizing payload weight, size and location on R/C models are major considerations and IDing your amateur call on an ATV transmitter from the craft is probably the last thing you want to have to add. However, you need to decide how and then if you want to add your call ID per loose or strict interpretation of FCC Rules. The ATV R/C application is not directly addressed in the Rules.

The simplest way to ID is to somehow put your call letters within view of the camera. While on an R/C aircraft most cameras are mounted on the belly, WA5FRF strapped his ATV transmitter, antenna and camera on top of the wing of his Tower Hobbies ARF TH-60 Trainer, and glued a triangular piece of balsa with his call on the nose. Depending on the camera depth of field, you may be able to paint or letter your amateur call on the belly forward of the camera. The letters just have to be large enough to be easily recognizable so the color of the letters should have high contrast to the color of the craft. Some experimentation with camera angle, placement and moving around call letters written on a piece of paper while watching on a monitor can be done.

If you have a few more ounces of payload available, the OSD-GPS video overlay board can not only give you your call ID overlaid on the camera video, but by adding a GPS receiver, give you speed, altitude, heading, time, latitude and longitude. You can just display your call if no GPS data is plugged in to the OSD-GPS, but if all you want is the call, the OSD-SA or OSD-PC will do the job. The OSD boards weigh 2 oz and are 2.5 x 3.5 inches. Power requirement is 8 to 14 Vdc at 80 ma. There are many small GPS receiver boards now available, like the Garmin 35, that are small and output the standard NMEA 0183 two line serial data which the OSD-GPS video overlay board accepts.

Identifying your call every ten minutes of continuous transmission and at the end of a transmission is required with the ATV mode as it is in all the others - 97.119. However, R/C transmitters under 1 watt are not required to ID per FCC Rule 97.215. The old R/C Rule was broad such that one could interpret that any transmitter used to control an R/C vehicle under 1 watt did not have to ID. Therefore, if an ATV transmission from the craft was used as a visual aid to Radio Control the craft, the ATV transmitter did not need to ID if its power was under 1 watt. When the R/C Rule and many of the amateur Rules were revised, the actual wording was changed to "transmissions directed only *to* the model craft." Strictly speaking the ATV transmitter would have to ID, but a 6 meter R/C control transmitter would not. One could argue that the spirit of the Rule is still being followed for the ATV transmitter if under 1 watt and no ID, but the wording does not cover transmissions *from* the model craft.

Another Rule to be concerned with is 97.111 which, with 7 exceptions plus the 97.215 R/C and 97.201 Auxilliary Rules, prohibits one way transmissions. If the video is used as part of controlling the R/C craft by the R/C operator watching for visual clues, and the transmitter is under 1 watt, it is a legal one way transmission. If over 1 watt, however, you would have to direct your ATV transmission to at least one other ham.

Control of an ATV transmitter on the craft is another question that often comes up. 97.109 says that each station must have at least one control point. You cannot use a channel on your 6 meter R/C receiver since it is below 222 MHz (97.201), but you could with a 72 MHz R/C receiver legally. But practically speaking, you only need to be able to switch off the transmitter with in a reasonable time. So in my opinion, the short time it takes to land at the flying field, the control point, to turn it off would not require a separate control transmitter and receiver.

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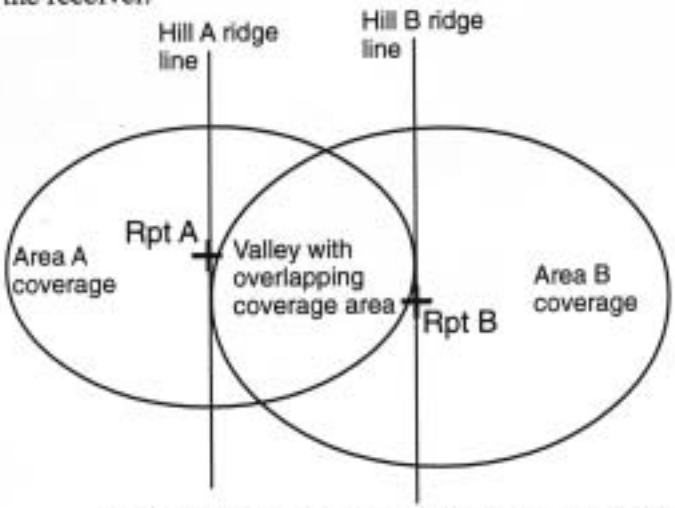
PC ELECTRONICS

VOR-3 VIDEO OPERATED RELAY
ATV Repeater Voting Application Note

Depending on terrain, power, antenna polarity, coordination and other variables, a new ATV repeater may not be able to operate without interfering with an existing one. However, with this voting system, a new repeater can operate in an area with overlapping coverage whenever the primary repeater is not on the air. There is often a problem between adjacent mountain ranges, during inversion skip or for occasional special purpose portable ATV repeaters at public service events.

421.25 MHz is the most popular ATV repeater output frequency because the lower the frequency the farther the line of sight distance given the same transmitter power level, antenna gains, etc. This frequency is also cable channel 57 which allows hams to try ATV by just sticking up an antenna at very little cost. But there can only be one inband ATV repeater on 70 cm in any area since there needs to be at least 12 MHz separation between the input and output frequencies so that the VSB filter attenuation curve is down far enough to keep from desensing the receiver.



One of the most common scenarios is the interference potential to ATVers in the valley in-between mountain ranges. Those in the valley would be able to receive both ATV repeaters depending on signal strength, beam pattern, etc. They could be working someone on repeater B who is on the other side of the hill when someone in Area A comes on not knowing that if both repeaters come on simultaneously, the person in the valley will receive interference. If Repeater B is coordinated and A is not, then it is A's responsibility to insure there is no interference. The voting system discussed here can allow repeater A to operate legally anytime that repeater B is not on the air.

At the new, or secondary repeater site, a receiver and antenna must be added set to the output frequency of the primary, or existing coordinated ATV repeater - it is OK if this is the same frequency as your repeater output. The receiver does not necessarily have to be an ATV receiver, it can just be a scanner or other low cost receiver that can tune to the frequency and has enough of an audio response to produce some horizontal sync at the speaker output that can be detected by the VOR-3 board. This will allow using 421.25 MHz, or other same frequency, for both repeaters in overlapping coverage areas. If there is just one FM voice or other mode coordinated repeater that could be interfered with, then Board A in the wiring diagram could be replaced with a CTCSS decoder or relay contacts to some kind of carrier operated relay. For more than one other repeater, more receivers and relays could be added but it may soon become impractical.

There may be occasional times when both repeaters will be on because the new repeater is transmitting first and will not be inhibited until the new repeater stops transmitting for 5 seconds. Also the new repeater could be keyed if there is more than 20 seconds when no one is transmitting to the existing ATV repeater.

In any case, it is best to try to work out a co-channel agreement with the owner of the existing coordinated repeater which likely will require that you demonstrate that your new repeater will be inhibited from operating whenever his is on the air and using the same frequency. Many frequency coordinators will coordinate a co-channel repeater in the same coverage area if there is a signed agreement between the two repeater owners. Coordination would protect you from a 3rd new repeater, but coordination is not necessary if your repeater does not come on when someone is using the coordinated repeater. This is a more efficient use of the spectrum.

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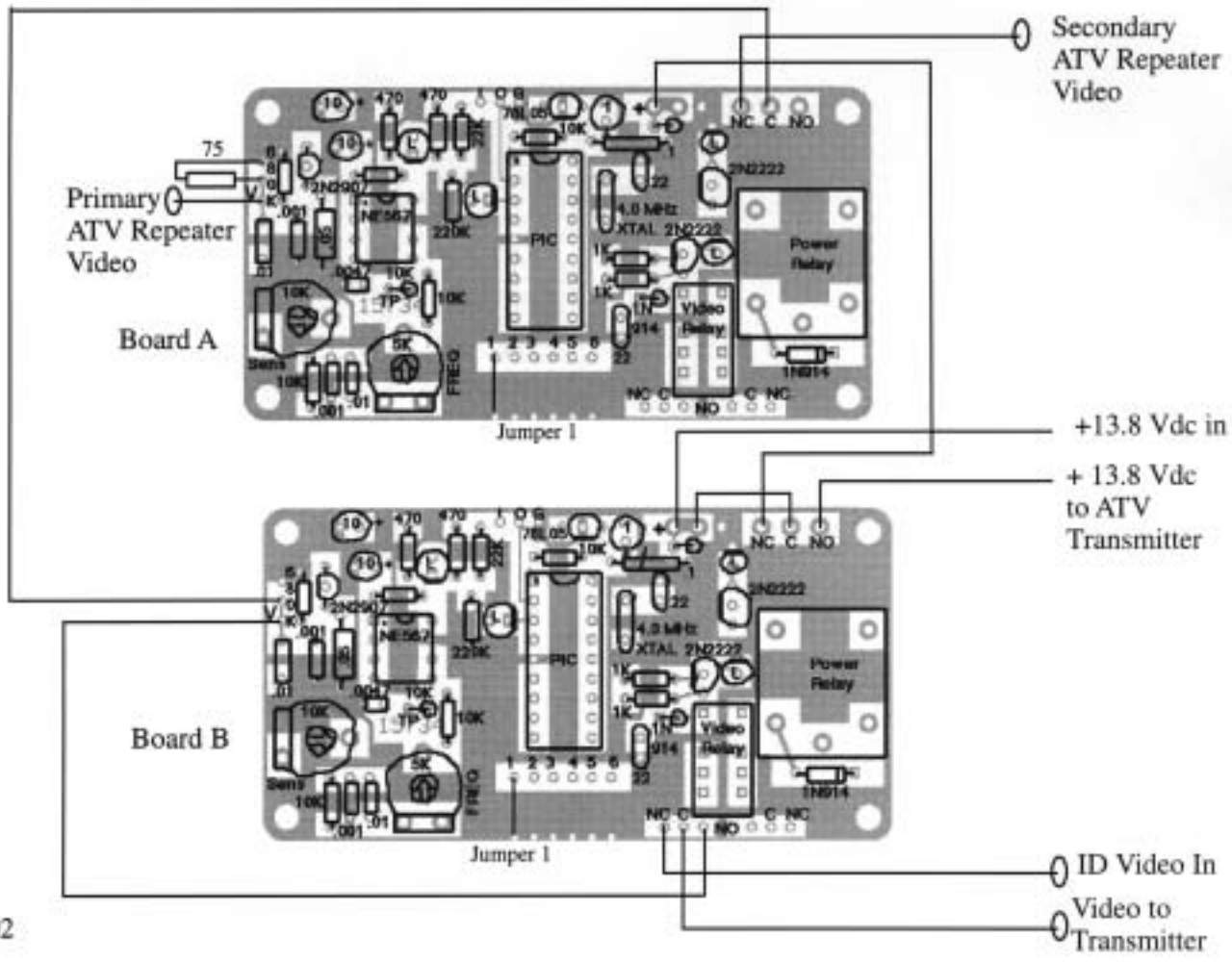
VOR-3 VIDEO OPERATED RELAY
ATV Repeater Voting Application Note cont.

If there are other transmitters at the new repeater site, you will need a single narrow bandpass filter in the antenna line to keep the receiver from being overpowered. It is always good amateur practice to have a bandpass filter in all antenna lines at a comm site to prevent intermod generation and desense. If you use a low cost scanner receiver, you may also have to put it into a shielded enclosure to keep RF from coming in through the plastic case.

When the primary ATV repeater is not on the air, the secondary video is looped through the normally closed power relay contacts on board A before going to the video input on board B. In this state, Board B will operate the secondary repeater normally. When a secondary video comes on, Board A loses its +13.8 Vdc which is connected to the normally closed contacts of board B, thereby making board B inactive. If there is no secondary video and the primary ATV repeater comes on, the board A power relay will open and no secondary video will get to board B and allow it to operate. The primary repeater has 20 seconds after drop out before the secondary repeater can be keyed up to allow some time between transmissions.



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Sparks Continued from page 13

This system would be fine. But, what if we want to do the same thing at night or in a closed in space? Well, it would need some form of light source or it would not show much. If we add a light source, how well would it work as a security camera? Not too well unless the light were infrared. If that was taken care of, how would we be able to see what went on while we were not at the monitor? A VCR would handle that, but what about those hours where nothing was happening? To fix that problem we need some form of motion sensing.

That means to be more useable in different environments we need to add the following things to our system:

* Infrared camera sensitivity
* Infrared illumination
* Video or physical motion sensor

It turns out that these things are pretty simple to add and will make the system useable in many more situations. Remember I said that the black and white cameras offered a unique advantage? The ones I have tested all have very good infrared sensitivity. That makes them an excellent choice for a wide range of illumination. All of these additions will be part of our final set up.

That wraps up the planning for the system. Next time we will put all the bits together and see how the system works for different uses and situations. With infrared and motion sensing the first test just might be to see what is going on at my friend's deer feeder. Hey, that would be fun!

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-Tom O'Hara,W6ORG,of PC Electronics in Amateur Television Quarterly -Spring 2001

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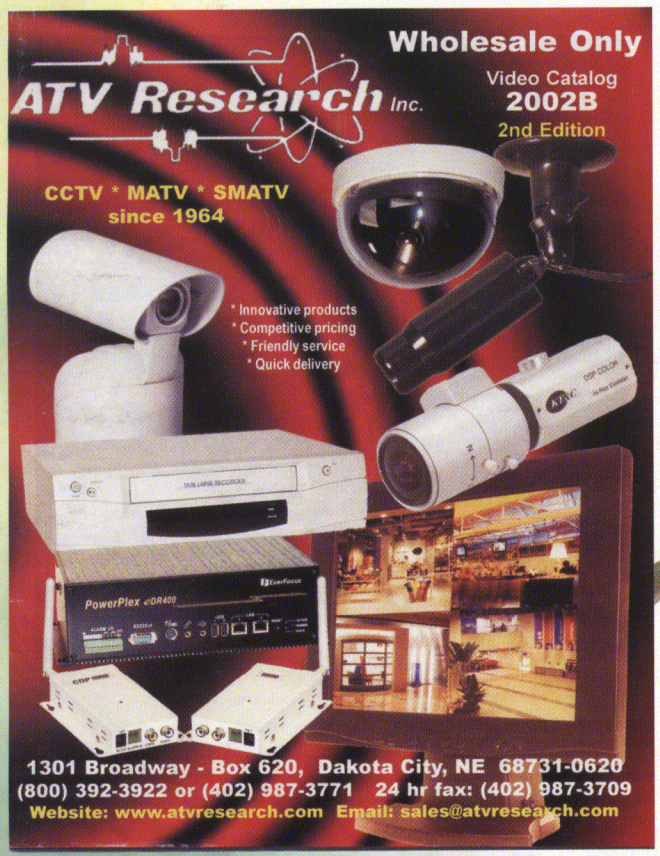

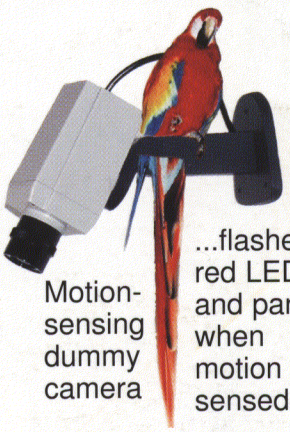

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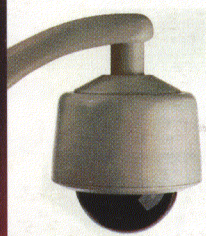

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